The FOUNDRY

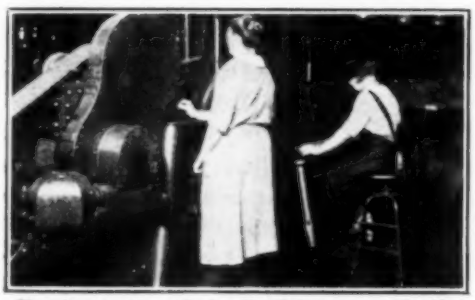
Volume 58
Number 11

Published
Semimonthly

CLEVELAND, OHIO, JUNE 1, 1930

Castings Aid in Manufacture Of Nuts and Bolts

WHEN one stops and considers the many uses for bolts and nuts, he wonders at the thousands that are used each day. To keep pace with the demand, factories must turn out hundreds of thousands daily. Their uses cover a wide range of fields from scientific instruments and the radio that you have in your home to their use as



Cleaning is One of the Final Operations in the Manufacture of Nuts and Bolts

temporary supports for large beams during the construction of large office buildings. Production methods and machines are used throughout the nut and bolt industry. Those devices include lathes, presses, burring machines, tapping machines, etc. In the hot process of production, machines that pierce, crown and eject the stock to containers are used. Similar operations are performed in the cold method of manufacture. Finished nuts are made on automatic lathes. After the nut has been formed, it must be tumbled, sorted, inspected and finally finished. Practically all finishing operations are performed on production machines or semi-production machines. One large producer carries in stock more than 3000 sizes and types of bolts and nuts regularly and that number does not include the much larger variety called for on special specifications. The apparatus and machines used in the forming, machining and finishing of the many sizes contain numerous castings. The accompanying illustration shows one of the automatic devices used in the cleaning operation.

Find Where Castings Can Be Sold.

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PUBLISHED BY THE PENTON PUBLISHING CO.,
Penton Building, Cleveland, O.
BRANCH OFFICES

CHICAGO.....1347 Peoples Gas Bldg.
CINCINNATI.....209 Edwards Bldg.
NEW YORK.....2203-2206 No. 220 Broadway
PITTSBURGH.....507-508 Oliver Bldg.
SAN FRANCISCO.....24 California Street
WASHINGTON, D. C.....1683 Pennsylvania Avenue
LONDON, ENGLAND.....416-417 Caxton House, Westminster, S. W. 1
BIRMINGHAM, ENGLAND.....14 New Street
PARIS, FRANCE.....No. 9 Rue de Londres
BERLIN, GERMANY.....Dahlmerstrasse 64A, Berlin Lichterfeld-West

Cable address, IROTRAPEN, London

SUBSCRIPTION

United States and Mexico.....$3.00 a year
Canada.....$4.00 a year
Great Britain and other Foreign Countries.....£1:0:0 a year
Single copies.....25 cents

Copies published three months or more previous to date of current issue, 50 cents each.

Member, Audit Bureau of Circulations, Associated Business Papers Inc., National Publishers' Association

The A. B. P. is a nonprofit organization whose members have pledged themselves to a working code of practice in which the interests of the men of American industry, trade and professions are placed first—a code demanding unbiased editorial pages, classified and verified subscribers, and honest advertising of dependable products

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A. F. A.

N. K. B. Patch
President Elect

E. H. Ballard
Vice President Elect

THE 1930 convention and exhibition of the American Foundrymen's association must be recorded as the greatest gathering in the history of the foundry industry. Never before has the call of progress been answered in such a manner. At Cleveland, all records for attendance and size were broken. During the five days of the convention, over 7500 members and guests registered at the association headquarters in the lobby of Cleveland's large auditorium.

A large attendance was attracted to the technical sessions by the valuable list of papers arranged through Secretary Kennedy. The meetings were interesting and in practically all cases, a large amount of discussion developed. The shop operation courses, covering the practical phases of the gray iron, steel and nonferrous branches of the industry were drawing cards. The discussion groups, held at a local hotel each evening, increased in popularity with each session, indicating that many of the convention visitors are anxious to obtain the type of information which develops in an informal discussion. The exhibition of equipment and supplies eclipsed any previous display. A total of 125,000 square feet of floor space was occupied, of which 85,000 square feet were devoted to the wide variety of exhibits covering every possible product used in the modern foundry. The exhibition was open Monday and Wednesday evenings, giving many foundry employes in the Cleveland territory an opportunity of seeing the display. Exhibitors reported an exceptional amount of interest in the displays.

During the week many of the visitors took advantage of the plant visitation program offered by the Cleveland committee. Hundreds of foundrymen visited one or more of the 12 foundries listed for plant visitation. At the same time, small parties secured permission to visit a great many of the interesting plants operating in the convention city.

Many social features added to the attractiveness of the week's activities. On Monday evening a special reception was provided by the Cleveland committee for the convention visitors. Dancing, entertainment and cards contributed to the pleasure of the evening. A buffet luncheon was served during the course of the evening. The most important social feature for the ladies was the sightseeing trip and luncheon on Tuesday. The party left the auditorium in busses about 10 o'clock and visited a number of important show places located in the parks scattered throughout the east end of the city. At noon the party arrived at the Shaker Country club, where luncheon was served and a special musical provided by the Cleveland committee. On Wednesday the ladies

Elected President

NATHANIEL K. B. PATCH elected president of the American Foundrymen's association for the coming year, is secretary of the Lumen Bearing Co., Buffalo, N. Y. He was born in Franklin township, Houghton county, Mich., Feb. 15, 1879. He received his early education in the public schools of Hancock, and Hubbell, Mich., and Buffalo. In 1897 he entered Massachusetts Institute of Technology but was forced to abandon his studies in 1900 because of eye trouble. From 1900 to 1901 he was employed by the Buffalo Smelting Works in various capacities. On Jan. 1, 1901, Mr. Patch joined the sales force of the Lumen Bearing Co., Buffalo, and continued in that capacity until July, 1904 when he was made manager of the Canadian branch at Toronto, Ont. In April, 1912 he returned to the Buffalo plant to act as secretary of the company and plant engineer and in 1913 he was advanced to the position of general superintendent of the Buffalo plant. Later he was made works manager, but continued as secretary through the various changes. Mr. Patch has been active in the work of the American Foundrymen's association for many years, last year acting as vice-president. He has served as chairman of many committees including the correlation committee and as a director of the association.

Convention at Cleveland Breaks All Records

were taken for a trip through the "Home in the Sky" and the Terminal tower and on Thursday they visited the Federal Reserve bank.

All the exaggerated libels on the Scottish race, through the medium of alleged humor directed at the Scots' thrift were repaid with interest at the annual exhibitors' dinner, held at the Statler hotel, Tuesday night. Sir James Alexander, eminent lecturer, traveler and industrialist and editor of the Glasgow *Chronicle*, did this little service in telling several hundred foundrymen and equipment manufacturers what he thought about American customs, habits, and overrated accomplishments. As a member of the British industrial commission on a former trip, he had full opportunity to study and observe. Further, being blessed with a keen analytical mind, he stripped the sham and pretense from many of the most cherished American precepts.

Harry A. Standart, Northern Engineering Works, Detroit, and president of the Foundry Equipment Manufacturers' association, presided. He introduced S. T. Johnston, S. Obermayer Co., and National Engineering Co., Chicago, as toastmaster. Others at the speakers' table included C. E. Hoyt, executive secretary of the A. F. A.; President Erb and Vice President Patch; Arthur E. Jensen, Hanna Engineering Works, vice president of the Equipment association; J. G. Pearce, director, the British Cast Iron Research association, and Sir James Alexander. After various entertainment features, and Sir James' address, the latter obliged by rendering some selections from several well known Scottish songs. Incidentally, Sir James unmasked, acknowledged his American origin and residence and thus disclosed a clever frameup by some of the Caledonian members of the equipment group.

Following the custom of many years, the banquet and related features staged Thursday night in the ball room of the Hotel Cleveland, constituted a climax to a week of many activities in the convention hall, on the exhibition floor and in many social centers.

Dr. W. E. Wickenden, president Case School of Applied Science, Cleveland, acted as toastmaster and also delivered an address on technical education in which he stressed the important part of the engineer in industry and the need of more men with technical training in this field. According to his statement the opportunities are greater than ever for men with technical training and the supply does not equal the demand.

The musical program was supplied by Genevieve Irene Rowe, soprano, accompanied on the piano by her father, Professor Rowe, Wooster, O. Miss Rowe was the winner of the 1929 Atwater Kent national audition. John Thomas Goodwin, past president of the Institute of British Foundrymen and for many years general manager of the Sheepbridge Coal & Iron Co., Sheepbridge, England, presented the felicitations and good wishes of the institute and incidentally touched upon some of his experiences and impressions since his arrival in the United States. J. G. Pearce, director of the British Cast Iron Research association, author of the

Made Vice President

EGBERT H. BALLARD, recently elected vice president of the American Foundrymen's association, was born March 3, 1875 in Hartford, Conn. In 1885 his family moved to Lynn, Mass., where his father was connected with the Thomson-Houston Electric Co., one of the companies later merged to form the present General Electric Co. From the age of 13, Mr. Ballard worked in various departments of the plant during school vacations. In 1894 he accepted a position as clerk in the steel foundry department which had just been started. Through W. P. Darling, manager of the steel foundry, he was given opportunity to obtain special training in laboratory and general foundry work in connection with his regular duties. A common school education was supplemented by night school and correspondence course. In 1905, Mr. Ballard resigned to accept a position as superintendent of the Massachusetts Steel Casting Co., Everett, Mass. This company later was absorbed by the General Electric Co. For the past several years he has been general foundry and pattern shop superintendent of the General Electric Co., plants located at Lynn and Everett, Mass. He is a past president of the New England Foundrymen's association and a member of the committee on industrial education of National Founders association.

annual exchange paper of the Institute of British Foundrymen, also sat at the speakers' table.

John A. Penton, chairman of the board of the Penton Publishing Co., founder of THE FOUNDRY, and donor of the gold medal which bears his name, presented the medal in person to Harry A. Schwartz, manager of research for the National Malleable & Steel Castings Co., Cleveland, in recognition of his outstanding service and contributions to the foundry industry over a period of many years.

The principal address of the evening was delivered by Dr. Allen D. Albert, Chicago, who chose for his subject, "The New Economic Revolution." He is assistant to Rufus C. Dawes, president of the Century of Progress celebration scheduled for presentation in Chicago in 1933 and devoted part of his address to a description of some of the features of that event.

Industries to Exhibit

It is interesting to note that exhibit features of the new Chicago world's fair will permit educational displays by entire industries. Probably the foundry industry will participate.

Warm welcome and sincere hospitality toward the American Foundrymen's association was voiced at the business session in the ballroom at the auditorium at 2 p. m. Tuesday, when the chief executive of the city and chairman of the local committee on arrangements spoke their greetings. President Fred Erb called the session to order and introduced Walter L. Seelbach, general chairman of the local committee on arrangements who presented Hon. John D. Marshall, mayor of Cleveland. Mr. Marshall commented upon this fourth return of the American Foundrymen's association to Cleveland, the last previous convention having been when the new auditorium practically was opened by the foundrymen. He expressed a real sense of friendliness actuating the city in its welcome to the invited members and delegates and he asked them to make their wants known should they wish to visit or inspect any of the great multitude of municipal activities. Mr. Seelbach brought the greetings of the local committee and outlined the entertainment plans.

Following Mr. Seelbach's speech, President Erb delivered the presidential address in which he stressed the value of the application of science to industry. By that means, waste can be eliminated from the foundry field and much time and money can be saved. He also stressed the value of science and stated that it was the chief ally of industry. He said that the successful foundryman was the one who had the ability to assimilate present day knowledge and apply it to his needs.

He then called on Vice President N. K. B. Patch, who, as chairman of the divisional activities correlation committee, outlined the activities of the various committees during the past year. Mr. Patch stated that those committees had been exceedingly active and that a complete report of the correllation committee, which was too long to read at that time, would be published in the *Transactions*. Executive Secretary Hoyt followed with a report of the condition of the association.

Work Is Judged

JUDGES of the national apprentice contest of the American Foundrymen's association have announced that the patterns and castings made by the following foundry apprentices should be awarded the prizes as specified in the contest regulations.

In the gray iron division the winners are: Moroni Heap, Brown & Sharpe Mfg. Co., Providence, R. I.; William Fielding, General Electric Co., Lynn, Mass.; Everette Fields, Rock Island Plow Co., Rock Island, Ill.

Winners in the steel division are: William Norton, Hubbard Steel Foundry, East Chicago, Ind.; Clarence Janes, Hubbard Steel Foundry, East Chicago, Ind.; Ralph Adams, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.

The following winners are included in the pattern division: Peter Walzer, General Electric Co., Lynn, Mass.; Charles Deak Jr., American Steel Foundries, East Chicago, Ind.; Leon Dionne, American Manganese Steel Co., Chicago Heights, Ill.

Following the custom of the association in electing past presidents honorary members, S. T. Johnston was elected. Mr. Johnston expressed his appreciation of the honor that had been bestowed on him. President Erb called on Secretary Hoyt to read a cabled greeting from the Institute of British Foundrymen. The convention moved to send greetings to each of the foreign foundrymens' associations who were members of the exchange arrangements between European and American societies.

A committee on resolutions composed of B. H. Johnson, R. D. Wood & Co., Philadelphia, chairman; Fred Kirby, John Deere Spreader Works, Moline, Ill.; and H. S. Simpson, National Engineering Co., Chicago, was appointed. A resolution was introduced calling for a standing committee on foundry education that should co-operate with engineering colleges in outlining a course of instruction to increase the familiarity of engineers with foundry products. D. M. Avey, Penton Publishing Co., Cleveland, then explained the resolution and said that foundrymen had made little effort toward increasing the prestige of foundry technique in institutions of higher learning. As a result, a false opinion of the usefulness of foundry products had been acquired by many institutions. The resolution was accepted unanimously.

Election Results Given

The president then called on the executive secretary for a report on the election of officers. He announced the election of N. K. B. Patch, Lumen Bearing Co., Buffalo, president; E. H. Ballard, General Electric Co., West Lynn, Mass., vice president and C. S. Anderson, Belle City Malleable Iron Co., Racine, Wis.; H. R. Culling, Carondolet Foundry Co., St. Louis; Fred Erb, Erb-Joyce Foundry Co., Detroit; R. M. Maull, Tabor Mfg. Co., Philadelphia; and D. M. Scott, Symington Co., Rochester, N. Y., and Gould Coupler Co., Depew, N. Y., as directors.

Twenty-five foundrymen, instructors and students gathered in the Hotel Statler Wednesday evening for the annual foundry instructor's dinner. The meeting was under the chairmanship of Prof. A. E. Wells, director, engineering shop laboratories, Cornell university. Following the dinner, B. H. Johnson, R. D. Wood & Co., Philadelphia, addressed the gathering on the place of the engineer in the foundry. He stated that there was a great need for foundry engineers and spoke of the opportunity in the field. He classified engineers in two types, designing and production engineers. According to Mr. Johnson, the latter type is the one most needed in the foundry. Following Mr. Johnson's talk, Prof. Wells brought out the point that it was the foundrymen who should come to the schools for men. If the industry wants men it should make efforts to get them and not use dilatory methods to secure them when they are in demand in other lines of endeavor.

C. J. Freund, Falk Corp., Milwaukee, gave a short talk in which he said that he wondered if it was possible for the instructors to present

the subject in a more interesting and glamourous light. It was brought out that it was impossible to give a large amount of time to one subject in a general engineering course. Some school foundries were woefully lacking in equipment and said that it was practically impossible to get equipment for the price that they could afford to pay for it. Many voiced instances where students had been placed in foundries during vacations and had been given no encouragement. It was the opinion of both instructors and foundrymen that the condition in which the foundry industry finds itself today, namely, the dearth of technically trained men with a knowledge of foundry operations, was the fault of the industry itself.

Among those who expressed opinions for the instructors were O. W. Potter, University of Minnesota, Minneapolis; C. H. Casberg, University of Illinois, Urbana, Ill.; J. W. Benley, Pratt institute, Brooklyn, N. Y.; F. A. Sefing, Michigan State college; R. E. Wendt, Purdue university, West Lafayette, Ind.; and W. H. Dosey, Carnegie Institute of Technology, Pittsburgh. C. E. Beard, Ohio State university, and C. C. Sigerfoos, Purdue university, expressed student views.

Steel Course Holds Interest

APPROXIMATELY 50 steel foundrymen gathered in the club room of the Public auditorium Tuesday to discuss cleaning and finishing of steel castings in the first of a series of steel shop operation courses. The meeting was under the leadership of S. R. Robinson, Ohio Steel Foundry Co., Bay City, Mich., formerly a division of the Industrial Brownhoist Corp., Cleveland. Mr. Robinson outlined some of the points of interest in cleaning and finishing practice. He then called on E. H. Ballard, general foundry and pattern-shop superintendent, General Electric Co., West Lynn, Mass., who discussed the methods his company has adopted to eliminate dust in its foundries. He said that his company had spent thousands of dollars in the improvement of sandblast operation with especial reference to the provision of healthful conditions in that machine. He also told of the necessity for good illumination in the sandblast. Other parts of the foundry cause a great deal of dust and methods of reduction of that hazard were discussed. Oiling of dirt floors and the possibility of the use of a portable room over the shakeout were methods mentioned as tending to reduce dust in foundry air.

Discuss Riser Removal

The relative merits of different methods of riser removal with regard to cost were discussed. There was a divergence of opinions as to the best method to use. The use of city gas, oxyhydrogen and oxyacetylene methods were discussed. J. Suttie, works manager, American Steel Foundries, East Chicago, Ind., led the discussion on the selection of grinding wheels. He said that his company paid for its wheels on the basis of material removed.

The sequence of cleaning operations occupied the interest of the group and much discussion was given on that subject. No special rotation of operations has been adopted universally. Other subjects discussed covered the cost of abrasives, cleaning of annealed castings, pressures used in sandblasting, safety devices on sandblast hoses, handling of gear blanks to prevent cracking and the sterilization of clothing worn by sandblast operators.

In addition to Mr. Ballard and Mr. Suttie, Frank A. Sherman, Dominion Foundries & Steel Ltd., Hamilton, Ont.; W. G. Kirkman, Harrison Steel Castings Co., Attica, Ind., and C. K. Garrison, Chicago Steel Foundry Co., Chicago, entered into the discussion.

Probe Core Practice

The second of the series of shop operation courses in steel foundry practice was devoted to core room practice with J. M. Sampson, General Electric Co., Schenectady, N. Y., as chairman. Many comments were made on the various types of core ovens and on regulation. Different core binders used in various practices also were brought out as well as the factors that induced the adoption of the practices. It was pointed out that control of core sand is an important item. It reduces the labor and rods necessary in the making of cores and also keeps the product more uniform.

W. F. Wilson, American Steel Foundries, Indiana Harbor, Ind., spoke on the use of core machines in the foundry and outlined the practice used in his plant for various type cores. He also spoke of the use of aluminum core plates. H. E. Mooney, Falk Corp., Milwaukee, told of the various difficulties encountered in cores. He exhibited a portion of a core that weighed 22 pounds and was filled with steel due to metal penetration. Methods of preventing metal penetration were advanced such a coating the cores with a material that would form a glaze as the metal struck it and thus prevent that phenomenon. It was brought out that one foundry was using the magnesia from pipe coverings, suspending it and spraying it on cores as a wash. According to the speaker, that material gave excellent results.

The use of pitch in steel foundry cores was discussed at some length. Some foundries use that material but it was the general opinion that it could not be used advantageously in steel foundries. However, it was said that gray iron foundries used that material to some extent. Bonding agents used in cores received much attention and several practices were outlined. Oil, clay and cereal binders were recommended depending on the class of work. Combinations of the various binders also were used in the practices mentioned.

The final shop operation course in steel foundry was under the leadership of A. W. Lorenz, Bucyrus-Erie Corp., South Milwaukee, Wis. Mr. Lorenz opened the meeting by showing the ease with which alloy steels, especially the more complex metals, develop internal cracks and the influence of inclusions on the machinability of castings. He then called on H. P. Evans, Hubbard Steel Foundry Co., East Chicago, Ind., who spoke on the characteristics of 12 to 14 per cent manganese steel. He explained the transformations that take place in heat treatment and explained the field in which manganese steel serves best. That field is where an impact-abrasive action occurs. He explained the instability of the steel and showed that even slight work changes its structure. Probably its most famous property is its toughness.

Consider Carbon Content

Following Mr. Evans' talk, there was some discussion as to whether the carbon and silicon were changed slightly in some cases to give better castings to withstand special services. Mr. Evans said that he never ran his carbon below 1.10 per cent because, in an analysis of the failures of manganese steel castings, it was

found that 75 to 80 per cent occurred in castings which had a carbon content below that figure. Burning of manganese steel is frowned upon but where it is necessary the casting should be annealed again in most cases.

D. Zuege, Sivyer Steel Casting Co., Milwaukee, followed with a talk on the method of heat treating pearlitic alloy steels. He explained the difference between the effects of the various alloys on the critical points and why certain steels are air hardening. Mr. Zuege, also said that alloy steels are more tender than carbon steels, explaining the statement on the ground of the relative heat conductivity of alloy and plain carbon steel. He also stated that often one group of alloys will give the same properties in a steel as another. It is a case of fitting the alloys to the use of the casting and on the basis of cost. For certain castings the heat treatment of the individual casting is advisable for the best results.

A. C. Jones, Lebanon Steel Foundry, Lebanon, Pa., spoke on fuel oil characteristics. He divided fuel oils into two classes, those of the paraffine and asphaltum bases. He explained the relative B.t.u. values of the oils and said that the B.t.u. value parallels the gravity. However, he recommended that in buying fuel oils more attention be paid to viscosity. He also discussed various types of burner equipment and flue gas analysis.

Study Gray Iron Metallurgy

THREE papers dealing with the metallurgy of cast iron were presented Tuesday, May 13, under the chairmanship of R. F. Harrington, Hunt-Spiller Mfg. Co., Boston. Effects on cast iron of prolonged heating at 800-1100 degrees, Fahr., were described by R. S. MacPherran in a paper of which he was the joint author with R. H. Krueger, both with the Allis-Chalmers Mfg. Co., Milwaukee. Although the paper covered a great deal of detail, the author warned his hearers against making too many definite deductions from the data submitted.

Generally speaking high silicon materially accelerates the decomposition of the pearlite. Nickel does the same although not to the same extent. Chromium decidedly increases tensile strength at room temperature and delays decomposition of pearlite. It also holds up the strength at high temperatures. The tests seemed to indicate that heat resistant iron cannot be made by running on low carbon with high silicon and nickel to promote fluidity and machinability. A low silicon, low carbon iron is much to be preferred. The addition of even 0.5 per cent chromium greatly increases the stability of the carbide and the strength of the metal at high temperatures.

Discuss Thin Sections

To some extent the paper written by F. J. Walls and A. Hartwell Jr., Wilson Foundry & Machine Co., Pontiac, Mich., and presented by Mr. Walls, supplemented the general findings of the first paper. The principal difference is that the second paper was concerned primarily with light, thin sections, while the first paper dealt with comparatively heavy sections.

This difference gave rise to considerable discussion later when the question of brinell hardness came up. One member was referring to thick heavy castings, while another was thinking of extremely thin castings. In summing up the authors stated that to obtain maximum relief of stresses and a maximum of growth and change in hardness, it is necessary to heat at 950 degrees Fahr., and follow through by slow cooling. To obtain dead soft iron the author advised heating just below the critical point and then air cool. Hard cast iron of the species investigated was obtained by heating to 1500 degrees and then quenching in water. A much higher temperature is required for irons higher in silicon.

Blistering Brings Trouble

A. I. Krynitsky, bureau of standards, Washington, joint author with W. N. Harrison of the paper on "Blistering Tendency of Some Cast Irons When Enameled," claimed that the blistering of enamels on cast-iron ware has been a prolific source of trouble. His paper detailed the experiments conducted to determine the causes of this trouble and the proper remedies to adopt to prevent it.

Gas entrapped in the enamel obviously is the cause, but the cause of this gas always has been a debatable point. Accumulated data led to several conclusions: 1—Physical defects especially sponginess will cause blisters; 2—Composition of the enamel and method of application may be responsible for blisters; 3—The gases are CO and CO_2; 4—Blisters often originate in a thin surface skin known as a micro chill; 5—There are two kinds of nonblistering iron, one with a small content of combined carbon in the surface layer and the other in which cementite is stable; 6—During the early stages both irons evolve gas; 7—Addition of graphitizing agents may be beneficial, but it is harder to prevent the micro chill than the macro chill; 8—Removal of the surface layer by deep sandblasting appears to be the most practical remedy for the tendency to blister.

In the discussion following the reading of the paper on briqueting cast iron borings for use in the cupola, presented by Harry Rayner, Dodge Brothers Corp., Detroit at the 10 a.m. session Wednesday, a member claimed that while this method might have application in sand foundries, he had found that the iron from briquets was not suitable for use with permanent molds. H. Kimber, Holly Carburetor Co., Detroit, said he was familiar with the circumstances on which the former speaker had based his remarks and that an investigation had led him to the conclusion that the briquets were too small and were improperly prepared. They were too soft and therefore disintegrated before they melted with resulting oxidation of the metal. A third member claimed that his company had discarded the use of briquets altogether both in the sand and the permanent mold sections of the foundry. They might take up experiments again later, but at the moment they were not in favor of using briquets.

Refers to Experiments

Dr. Moldenke referred to early experiments he had tried in briqueting iron borings and then referred to a process now in use in Germany. The borings are given a preliminary heating which serves two purposes. It removes foreign material and it seems to help the borings to stick together when they are pressed. In this instance the borings are fed into a series of molds that pass under a hammer. As each mold passes under, the hammer compresses the borings into a briquet. He thought the method had advantages in small and medium size foundries where the capital cost of a large hydraulic machine might be prohibitive. An inquiry on the practice of packing the borings in cans brought no response.

Discussion following the reading of

the paper on continuous melting of cold stock in an electric furnace for use in a stove plate foundry, resolved itself into a number of reports from several members agreeing with the author of the paper in his claim that this method of supplying the iron has many advantages. The paper was presented by N. L. Turner, Beach Foundry, Ltd., Ottawa, Ont. H. M. Lane, H. M. Lane Co., Detroit, cited an instance of where iron is melted in a similar manner for miscellaneous castings and the cost of castings laid down in the cleaning room is slightly above 3 cents per pound. A written discussion by J. H. Freer, De Laval Separator Co., indorsed the opinion that electrically melted iron possesses superior physical characteristics. A. I. Krynitsky, bureau of standards, Washington, questioned the temperature quoted in the paper and pointed out some of the difficulties caused by superheating the iron destined to be poured into castings that are to be enameled.

The concluding paper by E. J. Ash, bureau of standards, Washington, presented the result of an elaborate series of experiments to determine the volume changes undergone by metals and alloys during casting. The subject was considered under the three heads under which shrinkage may be classified: Liquid shrinkage, solidification shrinkage and solid shrinkage.

Presents Exchange Paper

Two foreign papers, constituting the exchange papers from the Institute of British Foundrymen and from the Association Technique de Fonderie, and one American paper featured the session on gray iron metallurgy Thursday afternoon. Hyman Bornstein, Deere & Co., Moline, Ill., acted as chairman of the session with R. F. Harrington, Hunt-Spiller Mfg. Co., East Boston, Mass., vice chairman. The first paper presented was that by L. F. C. Girardet, Saint Die, Vosges, France, on "Simplified Methods for Controlling the Production of Cast Iron." In the absence of the author, an abstract was presented by J. W. Bolton, Lunkenheimer Co., Cincinnati, O. The author of the paper advocated the use of the shear test on specimens obtained from conical buttons attached to the casting proper. He also used these buttons for examination of fracture and for microscopic examination. In microscopic examination, the author had standard specimens in which the various types of graphite fineness or distribution were numbered. He also used the system on phosphorus, etc., and in comparing various irons he was able to designate them by a series of numbers.

Cokes Are Different

The second paper was presented by J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala., on "Carbon and Sulphur in the Cupola—Some Properties of Coke." Mr. MacKenzie concluded that from results obtained that different cokes have a considerable influence on the carbon content of molten iron. Sulphur in the iron increases with the sulphur of the coke if all other things are equal. Carbon and sulphur are mutually repellant. A high sulphur iron is hard to carburize and a low-carbon iron absorbs sulphur readily. E. E. Marbaker, Industrial Research & Engineering Co., Pittsburgh, inquired on the effect of volatile matter in the coke, and A. L. Boegehold, General Motors Co., Detroit, asked if there was any difference in the blast furnace cokes that would account for the carbon pickup. The first question was answered to the effect that as far as was known, the volatile content had no effect. Mr. MacKenzie stated that one of the blast furnace cokes showed a higher reactivity through the rapid temperature rise to 250 degrees.

The last paper was presented by J. G. Pearce, British Cast Iron Research association, Birmingham, Eng. Dr. Pearce's paper was entitled, "The Correlation of Mechanical Tests for Cast Iron." Conclusions drawn by the author were that proper correlation of mechanical tests and comparisons necessitates the use of standard bars and methods of tests. In his opinion the 1.2-inch diameter bar is suited admirably for experimental work. Under constant melting conditions, gray irons of the same composition vary continuously in strength with section-strength diminishing as section increases. In the same size bar decrease of silicon increases strength in the gray range. Transverse, tensile and compressive tests measure the same basic property of gray iron and for standardized tests on the same size bar, bear a constant ratio to each other for the same iron melted under the same conditions. The transverse is approximately double and compression approximately four times the tensile strength.

Comments Are Given

Comments on the value of the paper were given by Dr. Moldenke, Watchung, N. J.; J. W. Bolton, Lunkenheimer Co., Cincinnati; R. S. MacPherran, Allis-Chalmers Mfg. Co., Milwaukee, and Mr. Bornstein. Mr. MacPherran commented on the fact that he was glad to see that the British specifications did not mention chemical composition with mechanical properties and the author stated that it should not be done. When physical requirements are given, the foundry cannot be hampered by the addition of chemical composition as it must be free to choose the mixture from experience. Mr. Bornstein stated that he found as did Mr. Pearce that the hardness, tensile and other properties functioned together and gave desired information while chemical composition did not.

Reports Progress on Costs

APPROXIMATELY 200 members attended the foundry cost session held Tuesday morning under the chairmanship of A. E. Hageboeck, Frank Foundries Corp., Moline, Ill. In opening the meeting, Chairman Hageboeck said definite progress had been made by the cost committee not only in the direction of establishing a gray iron cost system but in its acceptance and in the working out of a standard cost system for nonferrous foundries. With those preliminary remarks, the chairman introduced John L. Carter, Sacks-Barlow Foundries Inc., Newark, N. J. who outlined a cost system for gray iron foundries recommended by the Gray Iron institute. One of the advantages of the institute's plan is the simplicity. The system has cost plans for various sized shops in the industry and gives plenty of leeway for expansion of the system to include accounts for large shops which are not necessary in small plants. Cleaning costs were found to be the most difficult to derive correctly. The system offers several methods of arriving at cleaning costs but the one recommended is that which is broken down to cover each operation.

In the discussion that followed, various foundrymen in the audience contributed opinions and asked questions which were answered by both Mr. Hageboeck and Mr. Carter. Among those entering into the discussion were J. C. Nierath, Kilby Mfg. Co., Cleveland; E. T. Runge, cost consultant, National Founders association; A. D. Booth, Campbell,

Wyant & Cannon Foundry Co., Muskegon, Mich.; W. R. Fisher, Union Switch & Signal Co., Swissvale, Pa. and Mr. Lindquist, Grabler Mfg. Co., Cleveland.

After the discussion on the paper presented by Mr. Carter, the meeting was turned over to Vice Chairman J. L. Wick Jr., Falcon Bronze Co., Youngstown, O. After some preliminary remarks, Mr. Wick introduced C. S. Humphrey, Westco Chippewa Pump Co., Davenport, Iowa, who addressed the meeting on the organizing of a nonferrous cost group. Mr. Humphrey stated that many advantages were to be derived from such an organization. One of the greatest advantages is that it promotes a close study of the various divisions of a cost system and gives foundryman a yardstick with which to measure his efficiency. His company has made a study of overhead since it joined the group with the result that the item has been reduced materially. The group issues a quarterly cost sheet and by this method the members compare costs. Since joining the group the speakers foundry has reduced its molding costs, melting overhead, and cleaning costs. The discussion resulted in an agreement that some method of securing accurate nonferrous costs was needed. N. K. B. Patch, Lumen Bearing Co., Buffalo, president-elect of the American Foundrymen's association, said a few words and in conclusion stated the foundrymen needs a yardstick to measure consumption of materials and efficiency, as a cost system provides.

Shop Course Attracts Discussion

THE first of the present series in the shop operation course was held under the leadership of C. J. Scullin, Alda Laboratories Inc., St. Louis, and was attended by approximately 300 men actively engaged as shop foremen or superintendents. Popularity of these sessions, according to an experienced foundry superintendent from southern Ohio, is due to the fact that the leader and those taking part in the discussion, got down to brass tacks.

Submit Questions

After the opening presentation, outlining the particular features selected for the meeting, members present were asked to submit questions on features in their practice which were not giving satisfaction. One question and answer which seemed to excite a great deal of interest touched upon a feature familiar to many foundrymen. The questioner stated that an important customer insisted on specifying the analysis of his castings and then reserved to himself the right to reject them if they failed to meet certain physical specifications. For example he asked for a close, dense, high test iron with carbon under 3 per cent and then rejected the castings because he could not machine them as readily as ordinary soft iron.

The answer which seemed to meet with the approval of the gathering was that while a customer may be justified in ordering an iron that will meet certain physical specifications, he is not justified in laying down an analysis to which the foundryman must adhere.

This particular session of the shop operation course was concerned with cupola materials, that is the materials which the gray iron foundryman has at his disposal for producing saleable castings. These materials include pig iron, scrap iron, coke and fluxing materials. Mr. Scullin discussed each of these features in turn and declared that only rarely is the material at fault for unsatisfactory iron. Manipulation of the cupola is the deciding factor. Poor or mediocre material will produce satisfactory castings if the cupola is handled skilfully. The best material can be ruined in a cupola that is operated ignorantly.

Both in the original presentation and in the ensuing question period he outlined the basic principles underlying successful cupola operation. Also he described the many annoying features which cause the foundryman trouble, even though sometimes they are beyond his control. For example although the melter knows that a certain brand and size of coke give eminent satisfaction, he is forced sometimes through conditions to utilize coke with different characteristics.

Use Enough Limestone

Function of limestone or any other flux is to keep the cupola clean during the melting period. Mr. Scullin advocated the use of plenty of limestone, if necessary up to 8 per cent of the coke charge. What is wanted is a slag that disintegrates easily.

Answering several questions on size, number and position of tuyeres he claimed that with proper supervision, a cupola with a single set of tuyeres properly designed will admit air to a cupola as long as it is necessary to keep the cupola in blast. He also touched upon the subject of volume and pressure. Quantity is all that really counts. The volume depends on several factors, including the diameter of the cupola and the weight and thickness of the iron and coke charges.

He favored small charges and a comparatively low volume of blast. The usual rule for computing the weight of the charge is to allow 1 pound for each square inch of cupola cross sectional area. Personally he favored even a lower figure, say about ¾-pound on the same basis.

Dr. Fritz Meyer, National Radiator Corp., Johnstown, Pa., collaborated with Mr. Scullin in conducting the meeting and discussed in considerable detail, the various features of the air blast as it affected cupola operation. The basic 30,000 cubic feet of air per ton of iron melted, is not a reliable factor. The volume of air must be regulated to meet several varying factors in any given installation.

Hold Second Meeting

The second session of the shop operation course on cupola materials and operation was presided over by R. S. MacPherran, Allis-Chalmers Mfg. Co., Milwaukee, assisted by J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala., and F. J. Walls, Wilson Foundry & Machine Co., Pontiac, Mich. Mr. MacKenzie outlined the functions of coke as a melting medium and described the peculiarities of different grades of this material and how they functioned under different conditions. He deplored the apathy or lack of interest shown by many foundrymen to co-operating in the general dissemination of information. A committee with which he is connected sent out 250 questionnaires in an effort to collect and correlate information on cupola practice. The response was less than 25 per cent.

Touching on the question of refractories he claimed that the method of operation was a more important factor than any other. For example a cupola running on long heats will show a more economical bill for refractory repairs than a cupola running on short heats. This is due to the fact that the initial heating and cooling of the cupola lining disintegrates the bricks to a considerable extent. An iron brick lining above the melting zone was recommended.

A curious experience of one mem-

ber precipitated a discussion on the effect of moisture in coke. He claimed that in the manufacture of extremely light piston rings cast individually, the moisture in the blast under ordinary atmospheric conditions affected the hardness of the rings. Installation of a system for removing the moisture from the air cleared up the trouble. Several members recited experiences to show that the addition of moisture to the coke resulted in substantial savings in coke consumption. However, they all admitted that they required dry coke for the bed.

Blast Pressure Debated

Opinions were divided on the relative merits of high and low blast pressure. Mr. Walls is a proponent of the high blast and claims that in his practice he uses a blast pressure of 24 ounces for a production of 25 tons per hour from his 72-inch cupolas. Anthracite coal was highly praised as a melting medium for the cupola, although at present it is not used to any extent for the purpose on account of the cost compared with coke.

During an argument on the disputed point on whether the center or the circumference of the cupola is the hottest, Mr. MacKenzie drew a sketch on the blackboard to show that the shape of the melting curve changed with the diameter of the cupola and the blast pressure. Under a low blast pressure the highest temperature is around the rim of the cupola. Under a more judicious application of the blast, the line of melting is approximately level. A high blast pressure raises the peak of the melting cone in the center.

H. W. Dietert, United States Radiator Corp., Detroit, at the 4 p. m. sessions Wednesday, demonstrated the formulas of which he is the originator for determining in advance the size and shape of the gates required on a casting, also a formula for determining the proper speed at which the metal should be poured to secure the best results in satisfactory castings and in the amount of metal to be melted. Mr. Dietert pointed out it is folly to melt enough iron to fill a great number of large gates when the same number of much smaller gates will suffice.

E. M. Handley, Chain Belt Co., Milwaukee, presented and explained a series of slides showing how the formula has been applied to a wide range of castings. In the ensuing discussion E. W. Smith, Crane Co., Chicago, claimed that the majority of casting losses may be traced to the condition of the sand rather than to either the gates or risers. In support of his claim he said that he practically has banished risers from his foundry and makes castings up to 1000 pounds without them. However, he also is strong advocate of properly designed gates, that is gates by which the metal may be distributed in proper volume and gently in the mold. He also made a plea for some concerted action among foundrymen to clear up the present confusing nomenclature.

F. J. Walls, Wilson Foundry & Machine Co., Pontiac, Mich., stated that in his foundry the gating system was based on the principle of a steady decrease in size between the upright runner, the horizontal runner at the joint and the gate entering the mold.

The gray iron section of the fourth and last session of the shop operation course was devoted to a consideration of high test cast irons under the chairmanship of H. Bornstein, Deere & Co., Moline, Ill., assisted by F. B. Coyle, International Nickel Co., New York.

T. F. Jennings, Utah Copper Co., Garfield, Utah, presented a paper on the use of chromium in cast iron based on his experience with large quantities of this material over a period of many years in the production of castings for grinding, conveying and crushing machinery.

In considering the question of high test cast iron, R. S. MacPherran, Allis-Chalmers Mfg. Co., Milwaukee, pointed out that the term is generic and may apply to irons ranging in strength from 30,000 to 90,000 pounds and naturally the methods of production vary according to the results required. Strong iron is made in the air furnace, by those fortunate enough to have this type of melting equipment, but in the majority of gray iron foundries producing this type of castings, the metal is melted satisfactorily in the cupola. In all instances the strength is predicated on a comparatively low carbon content, usually between 2.90 and 3.00 per cent. This condition is secured by the addition of steel scrap to the charge in amounts varying between 30 and 90 per cent. In some instances an entire steel charge is used.

Is Difficult to Handle

Answering a question from the floor Mr. MacPherran stated that the metal is more difficult to handle than ordinary gray iron, both in the molten and in the solid state. It must be melted extremely hot and poured quickly through large runners, preferably in dry sand molds. Chipping is more difficult and where this work is done on a piece work basis, the rates are increased.

Dr. Moldenke in discussing the methods of making alloy additions to the metal stated that in Germany the practice is to make up cement briquets containing a definite amount of the desired alloy. One man has adopted the ingenious expedient of pouring the cement and alloy into ordinary paper drinking cups. They are set away to dry and then used as required. He also explained the theory of carbon nuclei and their effect on the formation of graphite crystals while the metal is cooling. Addition of steel to the charge and melting the iron at a high temperature disseminates the carbon in small particles that do not act as nuclei in the formation of graphite crystals.

Apprentice Training Is Advancing

THOUGHTFUL and well prepared discussion characterized the apprentice training session held at 10 a. m. Thursday. The chairman, D. M. Avey, editor, THE FOUNDRY, Cleveland, opened the session and introduced C. J. Freund, Falk Corp., Milwaukee, who presented the report of the A. F. A. committee on apprentice training. Mr. Freund described the work of the committee in furthering interest in apprentice training.

The first paper was presented by E. H. Ballard, General Electric Co., West Lynn, Mass., who described the steps taken along this line by his company. Mr. Ballard stated that, of 1167 boys graduated from their apprentice courses in all trades, 50 per cent were still with the company. He stressed the importance of apprentice training as a means of supply for the skilled labor necessary to meet modern conditions of keen competition.

In the discussion which followed Mr. Ballard's paper the value of training older men was emphasized. It was also brought out that in the past other organizations had not had the success in retaining the apprentice after training, one organization reporting only 10 per cent. Careful

selection of boys to train and proper placing after training were advanced as methods of reducing the turnover.

Necessity and value of having the co-operation of foremen and department heads was brought out. At the Granite City and Indiana Harbor works of the American Steel Foundries, the foremen are required to write papers covering the subjects given the boys. This system keeps the formen on their toes and also proves valuable to the apprentice.

The second paper was presented by S. W. Utley, Detroit Steel Casting Co., Detroit, who discussed the question: "Where are the Young Foundrymen?" Mr. Utley warned of a need of skilled men in the future. He said that the attractive features of the industry must be placed before young men, and that the older men must make an effort to get the viewpoint of the young man.

At the close of the paper given by Mr. Utley, the question of how much it costs to train an apprentice, was raised. Vice Chairman Freund replied that careful records kept by the Falk Corp., Milwaukee, indicated that castings produced by the apprentices cost less than those made by skilled molders, even after allowing heavy extra burden charges to the apprentice work. Hence their apprenticeship program is costing them nothing.

Mr. Bergson, National Founders association, New York, illustrated some factors causing failure of training programs with charts. Mr. Bergson urged that above all the boys should be given a fair deal, and stressed the importance of care in selecting the applicants. At the close of the session the work of the Cleveland Trade school was discussed, and the results of the apprentice prize contest judging were given. Further information on the winners of the gray iron and steel molding and the patternmaking divisions will be found on page 128.

Nonferrous Sessions Further the Art

ONE of the most interesting papers presented at the Tuesday afternoon session on nonferrous founding was that by W. F. Graham and L. A. Meisse, Ohio Brass Co., Mansfield, O., entitled "Deep Etch Test of Brass." The deep etch test is not as formidable an operation as the name might indicate. The first essential is to have a smooth surface to work upon. A piece of metal like a solid bushing of any diameter is sawed off and the sawed surface filed and polished. Then it is subjected to the action of acids, in this case a solution of nitric acid of 1.42 specific gravity with 10 per cent by volume of hydrochloric acid gives satisfactory results, with an 8 minute immersion. The treatment reveals oxide inclusions, fissures and porosity invisible to the naked eye.

Treatment Can Be Applied

Since internal defects become apparent that otherwise would be unknown, the proper treatment can be applied. That may be effected either by changing gating methods, or by using deoxidizers that will eliminate such defects when production is started, and thus save the foundryman from monetary losses. No magnification is used, no expensive instruments are needed and there can be no question as to the value of this discovery to nonferrous foundry work. It affords a working tool, by which many hitherto afflictions of the brass foundryman can be overcome by a little preliminary work at the outset of starting a large production order. This paper excited much interest, and led to short discussion of the causes of the various defects rendered visible by deep etching.

The second and third papers presented dealt with opposite views on the use of brass ingot, and were discussed together. One of the papers was, "Application of Ingot Metal to Production of Brass and Bronze," by William Romanoff, H. Kramer & Co., Chicago, and the other was, "Overcoming Alloy-Ingot Troubles in the Brass Foundry," by W. E. Paulson, Thos. Paulson & Son Inc., Brooklyn, N. Y. Mr. Romanoff briefly touched on the methods, and described the care and scientific control necessary to produce a high grade ingot metal. He gave the results of a number of tests of metals showing that satisfactory physical properties can be obtained in the case of secondary metals when made into commercial ingots by the application of modern methods. Mr. Paulson outlined some of the difficulties he had encountered at various times when using such secondary metal, and contrasted the results as compared to the use of similar alloys when made from virgin metals.

The Wednesday morning session was exceptionally well attended by an interested audience. The first and second papers were presented by H. E. White of the Lava Crucible Co. of Pittsburgh, on the subjects of the care and maintenance of fuel-fired furnace linings in the nonferrous foundry, and on the selection and use of refractory maintenance cements in the nonferrous foundry. The discussion of these two papers centered largely around a diagram showing curves for computing the economical limits of furnace-lining maintenance. The subject was discussed by H. M. St. John, Detroit Lubricator Co., Detroit; R. L. Parsons and W. F. Graham, both with the Ohio Brass Co., Mansfield, O.; and replied to by Mr. White who stated that the object of making such curves is to keep records of the linings with the ultimate object of learning when it was most economical to discard them, and put in new ones. A lining may be discarded before its useful life is over, and it also may be continued in service long after the cost of upkeep is greater than installing a new one.

The next paper presented was entitled "Stronger Aluminum Castings by Improved Foundry Practice," by T. D. Stay, E. M. Gingerich, and H. J. Rowe, United States Aluminum Co., Cleveland. The paper described methods of determining the best way of gating aluminum castings to obtain the maximum strength. The results were obtained from test bars on the castings. It was found that in the case of an end plate for an airplane engine supercharger, when poured *two up* from gates on both ends, it was 10 to 15 per cent stronger than the same casting gated at one end only. A double-hooked lever casting was found to be 50 per cent stronger when it was gated so as to avoid the highly stressed parts.

Illustrate Die Casting

"Progress in the Die Casting Industry," by Marc Stern, A. C. Spark Plug Co., Flint, Mich., proved interesting. It was illustrated by lantern slides showing machines dating from 1877 to the present. Prominent machines now in use are the goose neck, and the plunger types. For the heavier alloys the author preferred the latter type, but for aluminum alloys it might be necessary to use the goose neck or a modification of it. H. M. St. John, Detroit Lubricator Co., Detroit; Sam Tour, Lucius Pitkin & Co., New York, and Dan Broggi, Neptune Meter Co., Long Island City, N. Y., entered into the discussion which largely was concerned with the stability of the zinc base alloys. It

developed that this difficulty has been surmounted by the use of an alloy containing 93.90 per cent zinc; 4 per cent aluminum; 3 per cent copper and 0.10 per cent magnesium. With some alloys tensile strengths as high as 50,000 pounds per square inch with elongation of 4 to 6 per cent have been obtained in the case of zinc base alloys, according to Mr. Tour. It also was mentioned that the same alloys of aluminum that are used in making sand castings are satisfactory for die casting purposes.

Keep Crucibles Clean

One subject considered at the discussion following the well attended roundtable luncheon was crucibles versus clay or sand-lined steel shells for pouring off from furnaces. There was little diversity of opinion on the subject of keeping the ladles, crucibles, and the furnace clean and as free as possible of accumulations of slag and dross, to be sure of getting clean metal. It is not reasonable to expect to make clean castings when using dirty ladles, crucibles or furnaces, and ways and means were studied for accomplishing the desired end. It was the opinion that well heated vessels, whether crucibles or ladles, were essential in the first place, also that linings that soften somewhat under the heat were a good feature. Small additions of sodium carbonate in the bottom of the hot ladle onto which the metal is poured helped soften the lining.

The same chemical used conservatively, also kept crucibles clean when used for melting purposes, but only small amounts should be used, due to its corrosive action on the crucibles. Occasionally it was found when carrying off high zinc alloys that a fluffy sort of a skull would be attached to the inside of the ladle. This was removed easily by inverting the ladle, and directing a blast of air into it, which blows out the deposit.

The relative merits of ladles and crucibles as carrying off vessels were hardly touched upon. Some thought that crucibles were best, but others objected to the expense of crucibles. However, it was stated that there was a greater temperature drop in the metal when carried off in crucibles than when carried off in lined ladles, but the crucible was considered cleaner. It might occur that the lining of a ladle would spall inside the lip and the small fragments of refractory lining wash into the mold.

Sulphur Should Be Watched

Another interesting subject was on the effect of sulphur in bronze castings and mention was made of the American Society for Testing Materials specifications relating to sulphur in nonferrous ingots. It was considered that by living up to these specifications little trouble from sulphur would be encountered. It was thought that the use of plaster of paris when alloying high lead bearing metals, would add sulphur to the metal. One member stated that he always used it in such cases and that the castings so made, had never failed to withstand pressures. In other cases it developed that sulphur had caused porosity. It was mentioned that this difference in the action of sulphur was due to the state in which the sulphur existed. In the case of plaster of paris additions for fluxing purposes, the sulphur would be in the form of sulphide, but when porosity developed it was oxidized to sulphur dioxide, a gas highly soluble in bronze.

Cupola Melting Has Field

The cupola method of melting brass was discussed and it was thought to have its field for some classes of castings. Like all other methods of producing liquid brass, the cupola method has advantages and disadvantages. The question as to what are the final chemical and physical differences between the melting of the same alloy, by the crucible, open-flame or electric furnace could not be answered until standard methods of casting test bars are agreed upon. By the present methods of casting test bars and using 88-10-2 copper-tin-zinc alloy, it is quite possible to get a variation in tensile strength all the way from 29,000 pounds to 60,000 pounds per square inch with elongation to correspond, simply by differently molding the test bars. In discussing phosphorus addition to red brass, it was shown that this element must not be too high in these alloys, otherwise it would cause dirty castings. Around 0.004 per cent was thought correct.

Investigate Malleable Problems

THE Continuous Process as Applied to Malleable Practice," was subject of the first paper presented at the Tuesday session on malleable iron founding, by B. R. Mayne, Saginaw Malleable Iron division, General Motors Corp., Saginaw, Mich. In the absence of the author, Mr. Joseph of the same firm presented an abstract of the paper and replied to questions raised. Milton Tilley, National Malleable & Steel Castings Co., Cleveland, asked why a low blast was used in the cupola and Mr. Joseph stated that due to the large amount of steel flashings employed, a blast of only 12 ounces was necessary.

Max Sklovsky, Deere & Co., Moline, Ill., inquired about the number of conveyors used, molding stations and the time interval between molds. It was stated that 11 conveyors with 112 molding stations were used, and that there were about six molds between the one being poured and the one being covered. Mr. Joseph mentioned that approximately 20 molds containing small castings are poured from a 300-pound ladle. Mr. Richardson, Austin Co., Cleveland; G. M. Thrasher, Kennedy Valve Mfg. Co., Elmira, N. Y.; C. Demmler, Walworth Co., Kewanee, Ill.; Mr. Kaufmann, Grabler Mfg. Co., Cleveland, and W. R. Bean, Whiting Corp., Harvey, Ill., also discussed the paper.

Discuss Machinability

The second paper presented was, "Factors Affecting Machinability of Malleable Cast Iron," by H. A. Schwartz, National Malleable & Steel Castings Co., Cleveland. Many discussed the paper, including W. F. Graham, Ohio Brass Co., Mansfield, O., who stated that he agreed with Mr. Schwartz. He presented some time studies on drilling, and stated he believed that the drill speeds employed in the tests by Mr. Schwartz were lower than those in commercial practice. T. M. Jasper, A. O. Smith Corp., Milwaukee, presented a written discussion which was read by R. E. Bryant, Jefferson Union Co., Lockport, N. Y. Mr. Jasper believes that high carbon, low strength malleable iron machined much better than low carbon, high strength iron. The latter iron is more difficult to handle in the foundry and consequently might be open to casting troubles. This statement was objected to by several who pointed out that low carbon, high strength malleable was the best product. Mr. Jasper also suggested two malleable specifications—one in which strength was the paramount object, and the other to meet requirements not so rigid.

Enrique Touceda, Malleable Iron Research institute, Albany, N. Y., read his discussion in which he mentioned that high or low carbon in malleable iron had little effect on

machinability, and that trouble on that score generally was from other sources. He believes that the effect of silicon was more important than carbon, particularly in the high carbon irons which have a tendency toward primary graphitization. Other discussions were presented by O. W. Boston, University of Michigan, Ann Arbor, Mich.; L. J. Kelly, Fort Pitt Malleable Iron Co., Pittsburgh, and J. H. Lansing, Danville Malleable Iron Co., Danville, Ill. Duncan Forbes, Rockford Malleable Iron Co., Rockford, Ill., presented Mr. Lansing's discussion. The last paper presented was on "Some Features of Pulverized-coal-fired Air Furnace," by E. F. Wilson, Jefferson Union Co., Lockport, N. Y.

Roundtable Follows

About 110 enthusiastic malleable iron foundrymen attended the roundtable luncheon on malleable iron founding which was held at the Hollenden hotel at 12:15 p. m. Tuesday. The meeting was directed by P. C. DeBruyne, Moline Malleable Iron Co., St. Charles, Ill., chairman, and E. E. Griest, Chicago Railway Equipment Co., Chicago, vice chairman. A list of 29 questions was given to each one attending the luncheon, but not all were discussed. Questions ranged from the difference in expansion and contraction of castings to the amount of fuel used in oil and powdered coal furnaces. One question was on the prevention of oxidation in annealing, and it was brought out that muffle furnace annealing does not decarburize as deeply as the pot method. A tight muffle is necessary to prevent oxidation, as are proper damper control and dense packing of castings. When the oven cools interior gas pressure is reduced so that air enters and promotes oxidation.

Several present spoke on the question of composition for annealing pots. In white iron pots it was stated that the composition should be such that the carbon always remain in the combined form to prevent warpage and growth. Another thing that will help is throwing the sulphur-manganese ratio out. In other words obtain a sulphur content from 0.20 to 0.30 per cent with a manganese content of 0.15 to 0.18 per cent. Alloy pots were mentioned but it was stated that the chromium content must be around 20 per cent to obtain the longest life and that such pots were expensive. No definite information was obtainable on actual comparative costs of the two kinds of pots. One speaker stated that they were trying pots made from a 0.20 to 0.30 per cent carbon steel produced in the electric furnace. These pots now had run 30 heats without growth or warpage.

Question Check Causes

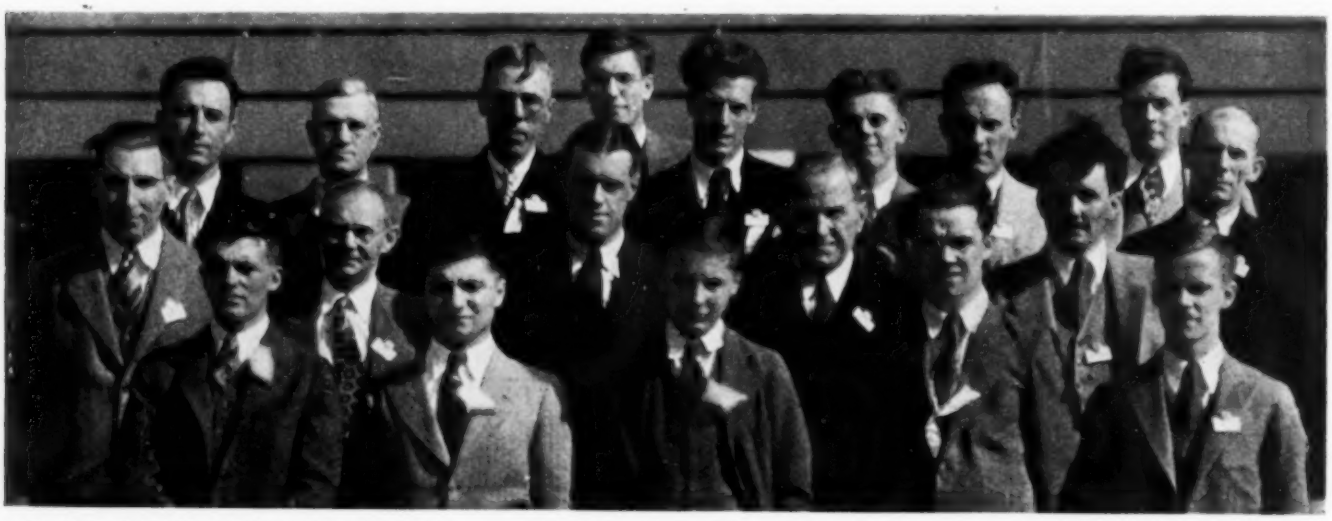
Another question covered the cause of checks in test bars. It was stated that these probably were cold shuts or closely related to them. No sea coal should be used and the sand should be open. With double-gated molds, the mold should be tilted so that the metal streams do not impinge in the central portion or gage length part of the test bar.

During the session it was stated that the American Foundrymen's association on malelable iron had gathered considerable material for use by engineers in malleable design.

Committees Review Work on Sand

CONSIDERABLE interest was shown in the control of foundry sand at the session on this subject held Wednesday afternoon. Approximately 250 were in attendance at the meeting which was under the direction of O. E. J. Abrahamson, Buffalo. The first paper presented was on the "Status of Foundry Sand Control as Seen by the Sand Producer," by W. W. Kerlin, Enterprise Sand Co., Pittsburgh, in which the author pointed out that the most important physical properties of a sand are the permeability, strength, and temper. To supply the desired sand, the producer must analyze his sands. In discussing the paper, Dr. Ries, Cornell university, Ithaca, N. Y., stated that the bond of molding sand is variable in composition, that the temperature at which the bond dehydrates is variable, and that in the examination of a considerable number of sands that the grains mostly were angular or subangular with few of the rounded type.

H. W. Dietert, United States Radiator Corp., Detroit, said that he believed the total fines passing through the 100 mesh screen was high and in his practice, he found the percentage in that range was 10 for boiler and 25 for plate molding. Mr. Kerlin stated that the sand could be coarsened by increasing the sand remaining on the 20, 28 and 35 mesh screens. However, this would not change the characteristics of the curves shown except to shift them to the left. Mr. Jensen, General Electric Co., West Lynn, Mass., inquired if there was any rule or formula for the best permeability. It was stated that there was no standard applicable



Technical Exhibits by Schools, Colleges and Universities Were Supervised by Both Students and Instructors

to all foundries. This factor would have to be determined for the various jobs that were being produced in each foundry.

The second paper was presented by W. F. Saunders and W. F. Saunders Jr., Providence, R. I., on the effect of heat on permeability of molding sands. Mr. Saunders stated that the sands were rammed in a silica tube heated by resistance wire. The temperature regulation was such that the temperature increased 50 degrees every 10 minutes up to 1000 degrees. Results obtained from the tests of a number of sands showed that as the temperature increased, the permeability decreased. This paper was discussed by Dr. Ries, W. W. Kerlin, H. W. Dietert, Mr. King, National Radiator Co., Johnstown, Pa., R. F. Harrington, and A. C. Jones, Lebanon Steel Foundry, Lebanon, Pa. The speakers stated that Mr. Saunders' tests gave indications of why green sand molds acted as they did, and it was due to the formation of steam and the expansion of the sand grains that caused the reduction of permeability.

The meeting was closed by the presentation of reports of the various sand committees and subcommittees. Dr. Ries, chairman of the main committee presented his report mentioning the work being done on rebonding clays to determine their green and baked permeability, compressive and tensile strengths, etc. He was followed by H. W. Dietert, chairman of the subcommittee on mold hardness and permeability tests who stated that a new hardness tester had been devised for testing hardness of molds. E. R. Young, Climax Molybdenum Co., presented the report of the subcommittee on methods of testing cores and R. F. Harrington, Hunt-Spiller Corp., East Boston, Mass., presented the report of the subcommittee on sand reclamation and conservation.

Brass Melting Features Course

THE first shop operating course on nonferrous foundry problems opened Tuesday afternoon at 4 o'clock with approximately 75 interested listeners. E. R. Darby, Federal-Mogul Corp., Detroit, chairman of the meeting was assisted by W. F. Graham, Ohio Brass Co., Mansfield, O., and G. H. Clamer, Ajax Metal Co., Philadelphia in leading the discussion. The session was devoted to red brass melting practice with fuel-fired furnaces and to aid the trend of discussion, Mr. Darby had prepared an outline covering the various points including types of furnaces, fuels, refractories, melting cost and operation. In discussing fuels, the opinion seemed to be that hydrogen of gas fuel was more active than carbon monoxide in oil fuel in gassing metal and that melting practice should be controlled to prevent the action of these gases.

Control Atmosphere

It was pointed out that methods of controlling atmosphere in the furnace were gained either by practical experience which could not be translated into words easily, or by gas analysis. The practical control was a type of gas analysis that came from observation. The difficulty of sampling the furnace atmosphere properly was mentioned by some speakers. Methods suggested were the use of various types of refractory tubes including water-cooled iron tubes and nickel-chrome tubes. Sometimes water displacement is used to collect the sample but it is open to objection. A combination of a pump with a double check valve and water collecting bottles was recommended.

Another speaker stated that the volume of air for the burners should be kept as constant as possible and that air line pulsation may cause considerable trouble in oxidized metal. Oil quality should be watched and low sulphur fuel oil used. Use of a covering of coke on the molten metal was suggested as a means of preventing metal trouble. The coke should contain little sulphur to prevent contamination of the metal with that element. While carbon dioxide generally is thought to be inactive toward molten metals, one of the speakers called attention to the fact that in brasses containing zinc, carbon dioxide oxidized the zinc to zinc oxide and also formed carbon monoxide which would react with copper. Use of high carbon fuel and a cupola melting unit for melting low zinc metals also was discussed.

Wednesday afternoon W. F. Graham, Ohio Brass Co., Mansfield, O., opened the meeting and introduced R. W. Parsons of the same firm who acted as leader. The subject of the meeting was the melting of red metal in the induction type furnace. Mr. Parson stated that with an 80 kilowatt furnace operating on a 9-hour day, 5-day week basis that the total power consumption was 375 kilowatt hours per ton of metal. In starting the furnace it was necessary to heat the block and channel and introduce molten metal sufficient in amount to cover both legs of the channel. The furnace then was filled with cold metal.

Compensate for Loss

In low zinc brasses about 10 per cent of the zinc content was added to compensate for zinc volatilization. During the holdover period about 200 pounds of metal was left in the furnace. When the metal was ready to pour the power is shut off and the difference in temperature between the first and last pot taken from the furnace was about 100 degrees under ordinary conditions. One speaker stated that in that type of furnace that the volatilization loss is about 0.25 per cent when clean metal is introduced. Other speakers indicated that the total metal loss due to volatilization and skimming ranged from 0.75 to 1.0 per cent.

Difficulty is found in melting aluminum bronze in the induction type furnace due to the aluminum oxide dropping down and plugging the channels. A different type lining than that for red and yellow brasses is used in melting nickel silver as the temperature ranges between 2300 and 2400 degrees.

Discuss Brass Melting

The topic of the Thursday meeting was red brass melting in the indirect arc type furnace and much data of interest was brought forth during the discussion. One speaker stated that in his smaller furnaces that all charging was done by hand without withdrawing the electrodes. The copper or composition ingots were placed behind the electrodes and on the bottom of the furnace by a peel. The gates, sprues and borings in that order were then shoveled in. A larger furnace also was charged with a wheelbarrow bucket without withdrawing the electrodes. The bucket was placed before the charging door. A chain was attached to the back of the barrow, and as the furnace was rotated, the charge was emptied into the furnace. Another speaker stated that the average kilowatt hour consumption on that type of furnace is 300 per ton on a 48-hour, 5-day week. Patching was done at the end of the week and the electrode consumption was 4½ pounds per ton of metal melted. Clay-lined steel ladles were used for pouring.

Metal losses came up for discussion

and it was stated that over a period of years the metal losses were distributed as 0.5 per cent in melting; 0.5 per cent in carrying metal from furnace to mold; 0.15 per cent in sandblasting, and 0.25 per cent in sweepings, grindings, skimming, etc. The foundry also was charged with 0.25 per cent nonmetallics in the metal delivered to it which made the total loss 1.65 per cent. Another speaker stated that his foundry showed a loss of 1.84 per cent. In discussing the use of larger transformers it was stated that local conditions determined the advisability of using them. If power costs, that is the demand rate is not too high, melting costs will be cut as a larger output can be obtained from a given furnace.

Defines Personnel

PERSONNEL management was the subject of the first of two sessions on management which were held Wednesday morning and afternoon. The morning session was attended by an interested audience which took an active part in the discussion of personnel work. The chairman, E. H. Ballard, General Electric Co., West Lynn, Mass., introduced Dr. Harry Meyer, Frigidaire Corp., Dayton, O., who encouraged an informal meeting and asked for open discussion at various points throughout his talk.

The definition of personnel work given by the speaker, is to make successful people. This concept was compared to the aim of industry which, he said, is to make successful products. A spirited discussion of the aims of industry came from the audience on these points.

"A keen personal interest must be taken in the employe, and he must be taught how to work and how to manage his affairs. If the man works without waste, proper compensation will come as a result of economic law," said Dr. Meyer. Six principles were given which aid work without waste. These include proper cleanliness, equipment, materials, instruction, supervision and pay.

Dr. Meyer closed his talk with an emphasis on order and cleanliness as a basis for efficient work, and stated that these two qualities are one of the most important considerations in the hiring of men.

The management session, was continued at 2 p. m. Wednesday, with B. H. Johnson, R. D. Wood & Co., Philadelphia, presiding. A paper covering the value of sales analysis and market research was presented by J. P. Newman, McGraw-Hill Publishing Co., New York. Mr. Newman emphasized the necessity of investigating the buyer's needs by going beyond the casting itself to find where and how it is used.

Copies of a paper on the value of cleanliness and neatness in a foundry, by E. Trapken, Sandusky, O., were distributed, and the paper made a matter of record. Chairman Johnson closed the meeting with a few remarks on the subject discussed by Mr. Newman. He mentioned that lack of investigation of the needs of the user had lost possible sales, in the past.

Move Shop Materials

THREE papers were presented at the 10 a. m. session on materials handling held on Friday, May 16. The meeting was opened by the chairman, D. G. Anderson, Western Electric Co., Chicago, who introduced W. M. Booth, Syracuse, N. Y. Mr. Booth presented the first paper, discussing materials handling and storage in foundry operations. He stressed three general rules for materials handling: Increase electrical and mechanical power; route work through the plant in as nearly a straight line as possible; keep waist-high movement of all materials involving labor. Losses to be avoided in storing materials particularly as affected by cold and snow, were discussed.

The subject of the second paper was "Core Room Conveyors," and was presented by D. B. Hill, Palmer-Bee Co., Detroit. With the aid of lantern slides Mr. Hill described economical methods of baking and handling cores in connection with continuous baking ovens. The relative merits of various types of ovens were discussed.

At the close of the second paper the meeting was thrown open for discussion. The question of cost comparison of the batch and continuous type oven was raised. It was agreed generally that the continuous oven is the more economical for large operations. Also the question of using waste heat was raised, and the opinion was that such a use was possible.

F. D. Campbell, Eastern Corp., New York, gave a paper on reducing materials handling costs in jobbing foundries. The necessity of cutting down accumulations of lost time was discussed. Mr. Campbell stressed the evils of lumping indirect costs, and stated that operations such as cleaning should be considered a part of the process and itemized as such. Materials handling was given as a field open to the foundryman for cutting costs which should be considered.

Steel Foundrymen Consider Sand

VARIOUS meetings on steel foundry practice at the American Foundrymen's association convention were well attended. Steel founders discussed the questions of sand control, metal penetration and core and mold washes extensively. Approximately 250 were present at the session on steel founding on Thursday morning at which D. M. Scott, Gould Coupler Co., Depew, N. Y., was chairman.

M. D. Pugh, Illinois Testing Laboratories Inc., Chicago, presented a paper entitled, "Profitable Reclaiming of Steel Foundry Sands." He spoke of the various methods of reclamation and said that there were two ways to reduce consumption. One was by reclamation and the other by conservation. He explained the difference between the two methods and said that in his opinion there was too great a tendency for steel foundrymen to eliminate too many fines and thus eat up the profits of the installation by demanding too much from it. Mr. Pugh has analyzed some 200 samples of reclaimed sands and he presented curves of the grain size of the samples divided into districts. He also presented some micrographs of the constituents of used sand on the screen and explained their meaning. A. Dierker, Ohio State university, Columbus, O., differed with Mr. Pugh in his explanation on the peeling action of sands. He believes the change in properties that the quartz grains undergo when cooling after being exposed to such a high heat was responsible for the action rather than the

grain size as advanced by Mr. Pugh. He also was of the opinion that small grains were not due to grain breakage. Ralph West, West Steel Casting Co., Cleveland, and Mr. Spencer, American Cast Iron Pipe Co., Birmingham, Ala., also commented on the paper.

Investigates Sand

George Batty, Steel Castings Development bureau, Philadelphia, presented a paper entitled, "The Most Potent Variable." F. A. Melmoth, Detroit Steel Casting Co., Detroit, commented on the paper and outlined some sand investigations that he had carried on in England 14 years ago. He warned against too elaborate sand reclaiming installations and emphasized the importance of close control and supervision of backing sand. Maj. R. A. Bull, Steel Founders Research group, Chicago, was of the opinion that not the quantity but the quality of the fines should govern the amount of removal. A. C. Jones, Lebanon Steel Foundry Co., Lebanon, Pa., also commented upon the paper.

The third paper entitled, "Notes on Behavior of Sand Molds in Steel Foundries," by Paul L. Goodale, Commonwealth division, General Steel Castings Corp., Granite City, Ill., was read by Maj. R. A. Bull in the absence of the author. The paper dealt with a theory advanced after an investigation of metal penetration into steel foundry sand when in the mold. The author found that various iron oxides and not metal were responsible for that condition. However, A. Dierker thought that this condition was due to metal alone rather than by the formation of oxides. A. D. Wilson, Wheeling Mold & Foundry Co., Wheeling, W. Va., found that alloys had an influence on the metal pentrating condition. George Batty, A. W. Lorenz, Bucyrus-Erie Corp., South Milwaukee, Wis., H. E. Mooney, Falk Corp., Milwaukee, and Charles J. Seal, Harnischferger Co., Milwaukee, also offered comment.

The final paper on the program was the Australian exchange paper entitled "Steel Founding as It Is Practiced in Australian Plants" by Daniel Clark, Newcastle, N. S. W., Australia.

The steel roundtable discussion held at noon May 15, was a session in which several questions were extensively discussed. The first question brought up was concerning the use of mullite as a mold wash. This material was said to be used in the following manner: Grind to 70 to 100 mesh. Take water and add about 2 per cent of bentonite and stir thoroughly, then add 2 per cent linseed oil. That solution will hold 60 per cent of mullite in suspension. The material is not so good for swabbing molds but may be applied by spraying with extreme ease and will give and even coating. When molten metal comes in contact with the material it forms a glaze on the face of the mold and prevents penetration. Fifteen inch cubes with a 2½-inch square hole through them have been poured using that material on the cores and cleaned easily. The material costs 4½ to 5 cents per pound. One speaker said that while the question said an inexpensive mold wash, he thought results in the cleaning room often warrant the use of a more expensive material.

Presents Formula

The second question dealt with green sand mixtures that do not require skin drying for work ranging from 1000 to 3000 pounds. One speaker said that he used a mixture of 1000 pounds new silica sand, 30 pounds of bentonite and 3 to 4 per cent moisture for castings of that size. He allowed the mix to stand over night before using. Others used the same mix but incorporated about 1 per cent cereal binder and found that it gave superior service in their estimation. It was brought out that with new silica sand 4 per cent bentonite, 1 per cent cereal binder and 4 per cent silt in the sand gave a fine mix. With old sand 2/3 of one per cent bentonite was necessary to keep up the bond. The latter two mixes were used with approximately 4 per cent moisture.

Debate Small Foundry

Methods of sand control in a small steel foundry was the subject of much discussion. All present believed that moisture was the important item in foundry sand. Technique of the mill operators must de developed and sand should be under control at the mold rather than at the mill. Control in both places was regarded as important. Moisture is considered an indication of the condition of the sand when the molder gets it. Factors that influence the condition of sand are distribution of moisture and the covering of facing sand to prevent evaporation of moisture. A method used in one foundry to control both production and milling time was the installation of an ammeter on the mill. This instrument was of the recording type and showed time of milling, batches made, time between mixes and gave an indication of the mechanical condition of the mill.

Another speaker expressed his opinion that sand control was a difficult matter to sell to the men in the foundry because of the use of technical names. However, when once sold, the men become over-enthusiastic on the subject. Temperature of sand was an important item in steel molding according to one speaker. It also was said that the most trouble with oil sand mixes was due to the fact that many foundries added the oil to wet sand which practice globulates the oil and prevents thorough distribution.

Consider Melting Furnaces

ONE of the closing sessions held Friday morning at 10 o'clock was devoted to melting furnaces and core practice, under the direction of E. F. Cone, Iron Age Publishing Co., New York, chairman, and William Romanoff, H. Kramer & Co., Chicago, vice chairman. Four papers were presented at the session including, "Some Considerations in Gating and Pouring Castings," by E. V. Ronceray, Paris, France. In the absence of the author a brief abstract of the paper was presented by R. E. Kennedy who stated that the author reviews considerations of gating and pouring castings, and shows how various methods of gating approach one of four conditions under which piping in the casting will not occur. He also discusses methods used to prevent inclusions of sand and dirt.

The second paper presented was on "Value of Analyses and Specifications for Core Oil," by J. A. Gitzen, Lindsay-McMillan Co., Milwaukee, in which the author stated that he believes it is possible to purchase core oils by specification and that such method should be followed. He said that in his experience, if the chemical analyses of organic compounds are identical, the physical properties produced also are identical. He also hoped that sufficient interest in specifications for core oil would be aroused to adopt a standard for that material.

"Induction Furnaces for Nonferrous and Iron Foundries," by Manuel Tama, Hirsch Kupfer & Messingwerke A-G., Finow-Mark, Germany, was pre-

sented in absence of the author by G. H. Clamer, Ajax Metal Co., Philadelphia. The feature brought out in the paper was the use of induction furnaces with cupolas for duplexing cast iron. The power used was about 60 kilowatt hours per ton, and Mr. Clamer estimated that the lining cost was about $200 a month for 300 tons of metal. The final paper was presented by H. E. White, Lava Crucible Co. of Pittsburgh, Pittsburgh, on "Study of Nonferrous Crucible Melting." The author discussed the use of the crucible melting furnace from the metallurgical, mechanical and economic points of view. He also spoke on the factors affecting efficiency which include design of burners, combustion chambers and refractories.

Advises Regulation of Steel Castings Industry

At the general session of the Steel Founders Society of America Inc. held Wednesday morning at the Hollenden hotel, Cleveland, at which John E. McCauley, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., presided, various committee reports were presented and accepted. Special attention was directed to the midsummer convention of the society which will be held at the Greenbrier hotel, White Sulphur Springs, June 26 to 28. No meetings of the society will be held during July and August. New companies welcomed into the association include the Hartford Electric Steel Corp., Hartford, Conn., and the Electric Steel Casting Co., Indianapolis. Announcement also was made of the intention of the American Steel Foundries to become a member of the association.

In presenting the report of the managing director of the Steel Founders' society of America, G. P. Rogers cautioned members to regulate their own industry before some agency, government or otherwise regulates it for them, or before it falls to a profitless stage, where it ceases to be of value or it no longer serves a useful purpose. Members of every industry must co-operate and act together, he pointed out, with the great power that comes from unified control as against the feebleness of scattered effort. Members' individual reports of business conditions showed inquiries as steady and operations ranging from 50 to 127 per cent.

Following luncheon at which Charles A. Leedy, *Youngstown Telegram*, Youngstown, O. was the principal speaker, the general session again was resumed. In speaking at this session on "firm bidding," W. W. Nichols, assistant to the president, Allis-Chalmers Mfg. Co., Milwaukee, emphasized that the practice of manipulating bids as between buyers and sellers reduces a sound business negotiation to the hazards of common gambling, invites confidential information for the purpose of procuring price advantages, wastes time and energy and encourages price cutting at the expense of fair dealing and honest values. The speaker defined the term "firm bidding" as the submission of a price accurately determined with reference to cost, to remain unchanged unless a change in buyer's specification warrants a different quotation. Firm bidding, he stated, precludes any suggestion of price fixing by the seller or any prospect of price revision in the mind of the buyer and will logically result in more accurate cost estimates, improve quality of products, increase plant efficiency, maintenance of wages and conditions of work at a satisfactory level, with lower prices to the consumer. The foregoing, he contended, are highly legitimate considerations in the public interest.

At the conclusion of the general session simultaneous meetings were held by the large and small castings divisions of the society. George H. Friesel, United Engineering & Foundry Co., Pittsburgh, presided at the session of the large castings division and L. S. Peregoy, president, Sivyer Steel Casting Co., Chicago, presided at the session of the small castings division. At the latter meeting A. K. Reading, general manager, Zimmerman Steel Co., Bettendorf, Iowa, explained the importance of a budget system in the control of a steel foundry or other type of foundry. The first presupposition of a successful budget, the speaker pointed out, is that there is or should be a profit on the cost of doing business. If a ratio of cost to selling as budgeted is maintained, a profit is bound to be had no matter what the sales may be. A friendly budget, especially one made and compiled by the chief executive, the speaker concluded, will provide the guiding sign posts leading to results which scarcely can be measured in enthusiasm, economy and real money.

Favors Alloy Division

The society also took favorable action on the formation of an alloy castings division, at a meeting at which T. H. Harvey, Ohio Steel Foundry Co., Lima, O., presided. That action increases the divisions of the society to three, namely, small castings, electric process; large castings, open-hearth process; and alloy castings, heat and corrosion resistant. The purpose of the new division is to promote general improvement in the manufacture and sale of alloy castings; to promote growth of business by expansion of possibilities; to secure wider market for its products; to correct abuses and bad trade practices; and to collect and disseminate information and statistics. Membership in the division will be restricted

Steel Founders' Society of America Met Two Days During Convention Week at the Hollenden Hotel

to qualified companies producing heat, acid and corrosion resisting products. The next meeting of the division will be held in conjunction with the midsummer convention of the society at which all producers of heat and corrosion resisting castings will be invited to be present. Thomas R. Heyward Jr., Duraloy Co., Pittsburgh, was elected chairman of the division.

Should Not Cut Prices of Gray Iron Castings

Citing the advantages of concerted trade association effort in stabilizing markets, Frank Dunning, general manager, National Builders' Supply association, Cleveland, speaking before a luncheon get-together meeting of the Gray Iron institute held at Hotel Cleveland, Cleveland, May 14, stated that in his opinion prices should be raised and not cut when sales volume falls. This should be done to maintain a steady level of profit, regardless of volume moved. Mr. Dunning reviewed briefly his experiences with the trade association movement, declaring that the value of these organizations is not appreciated generally, and that many, handicapped by insufficient budgets and incompetent personnel with poor salaries, amount to nothing more than agents to convene members for social purposes. Associations are getting away from this idea, however, and, according to Mr. Dunning, the trade association member who today fails to get more out of the association than the money he invests in it, and who fails to contribute something valuable to the association for other members, is in reality an undesirable element of the organization.

The luncheon was attended by nearly 100 members and guests of the Gray Iron institute, who took advantage of the concurrent meeting of the American Foundrymen's association to assemble and discuss various trade problems. Opening the business part of the luncheon, Walter L. Seelbach, president of the institute, introduced Arthur J. Tuscany, secretary, who in turn introduced six directors of the institute who were present. Mr. Tuscany then introduced Mr. Dunning who spoke at some length and was followed by J. G. Pearce, director of the British Cast Iron Research association, Birmingham, England, speaking upon aspects of the research question as applied to trade associations.

Mr. Pearce commended the work of the Gray Iron institute and advanced the hope that the organization would make every effort to promote the furtherance of research work in gray iron. He stated that a large share of all new developments in industry today is the direct result of the research worker who should be given a free hand, unrestrained by any commercial influence. The need for making operators of foundries, especially small foundries, "foundry conscious," realizing the importance of the casting industry and the extent to which research is beneficial, was mentioned by Mr. Pearce who foresaw an increased international co-operation between foundries so that information on research, trade practices, stabilizing markets, etc., might become world-wide in its scope. Activities of the British research association were described and the many ways in which the organization is helping the British foundryman outlined.

Sessions of various groups of the institute were held during the day and subjects up for discussion included costs; finance and budget; merchandising; research; trade information; and trade practice. For the most part these meetings were in the nature of progress reports indicating that the committees at work on these subjects were making substantial headway in working out the problems involved. The research committee has assembled over 600 representative test bars and at present is engaged in assimilating and tabulating physical properties and other data obtained on tests of these bars.

The cost committee has in process of development a cost routine for gray iron foundries based on a cost manual worked out by John L. Carter, Newark, N. J., chairman, a system presented before the cost committee of the American Foundrymen's association and included in the cost education program which that committee has sponsored for the past eight years. The Gray Iron institute has been growing steadily in membership, it was brought out, and is rendering valuable assistance and advice to gray iron foundrymen. Between 300 and 400 institute members were in Cleveland attending meetings and the exhibition of the foundrymen's association. The annual meeting of the gray iron group will be held in October.

Overseas Party Dines

MEMBERS of the overseas party who attended the International Foundrymen's congress in Paris in 1923 and last year's congress in England held a reunion dinner, May 14, in the dining salon of the CITY OF CLEVELAND *while tied up at the D & C dock, Cleveland. About 64 members were present. S. T. Johnston of the S. Obermayer Co. and the National Engineering Co., Chicago, acted as toastmaster. Following the dinner the party returned to the lounge at the Public auditorium where motion pictures of the trip to the 1929 congress were shown.*

Brass Ingot Institute Favors Research

Plans for a program of technical research were approved and work of the institute during the past year was reviewed at the recent annual meeting and outing of the Nonferrous Ingot Metal institute held at French Lick, Ind., April 28 to 30. The institute is co-operating with the American Society for Testing Materials to formulate standards for specifications for ingot brass and bronze.

At the annual session of the organization, reports were recived and approved resulting in the financing by the institute of a research associate at the United States bureau of standards for the purpose of making an investigation into the physical properties of the ingot brass and bronze. With the results of this research, it is anticipated that the number of specifications that are now being requisitioned can be substantially reduced in number with resulting economy both to the consumer and the producer.

The officers of the institute were unanimously re-elected. They are: President, Benjamin Harris, president of Benj. Harris & Co., Chicago; vice president, Isadore Glueck, manager, Federated Metals Corp., Chicago; treasurer, Lazarus Chapman, vice president, H. Kramer & Co., Chicago.

The above officers, together with the following, will serve as the institute's executive committee: Jos. Axelrod, president, Girard Smelting & Refining Co., Philadelphia; William J. Coane, vice president, Ajax Metal Co., Philadelphia; T. Lewin, Lewin Metals Corp., East St. Louis, Ill.; and Leo Lowenstein, Nassau Smelting & Refining Works Ltd., New York. R. D. T. Hollowell was re-elected secretary-manager.

Crawford Oven Co., New Haven, Conn., is building a new office and factory at 200 Shelton avenue. The first unit is a concrete, brick and steel, one-story plant, located on the company's siding from the New York, New Haven & Hartford railroad.

EXHIBITION PORTRAYS
Industry's Progress

EXCEPTIONAL progress in the design and development of equipment for the foundry industry was well illustrated at the exhibition held in connection with the annual convention of the American Foundrymen's association in Cleveland, May 12 to 16. The show was the largest ever held in the history of the association, covering a total of 125,000 square feet of floor space in the large arena of Public auditorium, the spacious annex and the wide arcade connecting the two buildings.

A feature of the show was the completeness of the exhibits. In one instance four manufacturers combined efforts to operate a complete foundry on the floor of the exhibition hall. Each exhibit reflected an untold amount of care on the part of the exhibitor and should result in furthering the work of the industry.

The educational exhibits, housed in the arcade connecting the two exhibition halls, were far more extensive this year than ever before and created considerable interest among convention visitors. Displays were maintained by several committees of the American Foundrymen's association, numerous organizations allied with the foundry industry and a group of colleges and trade schools.

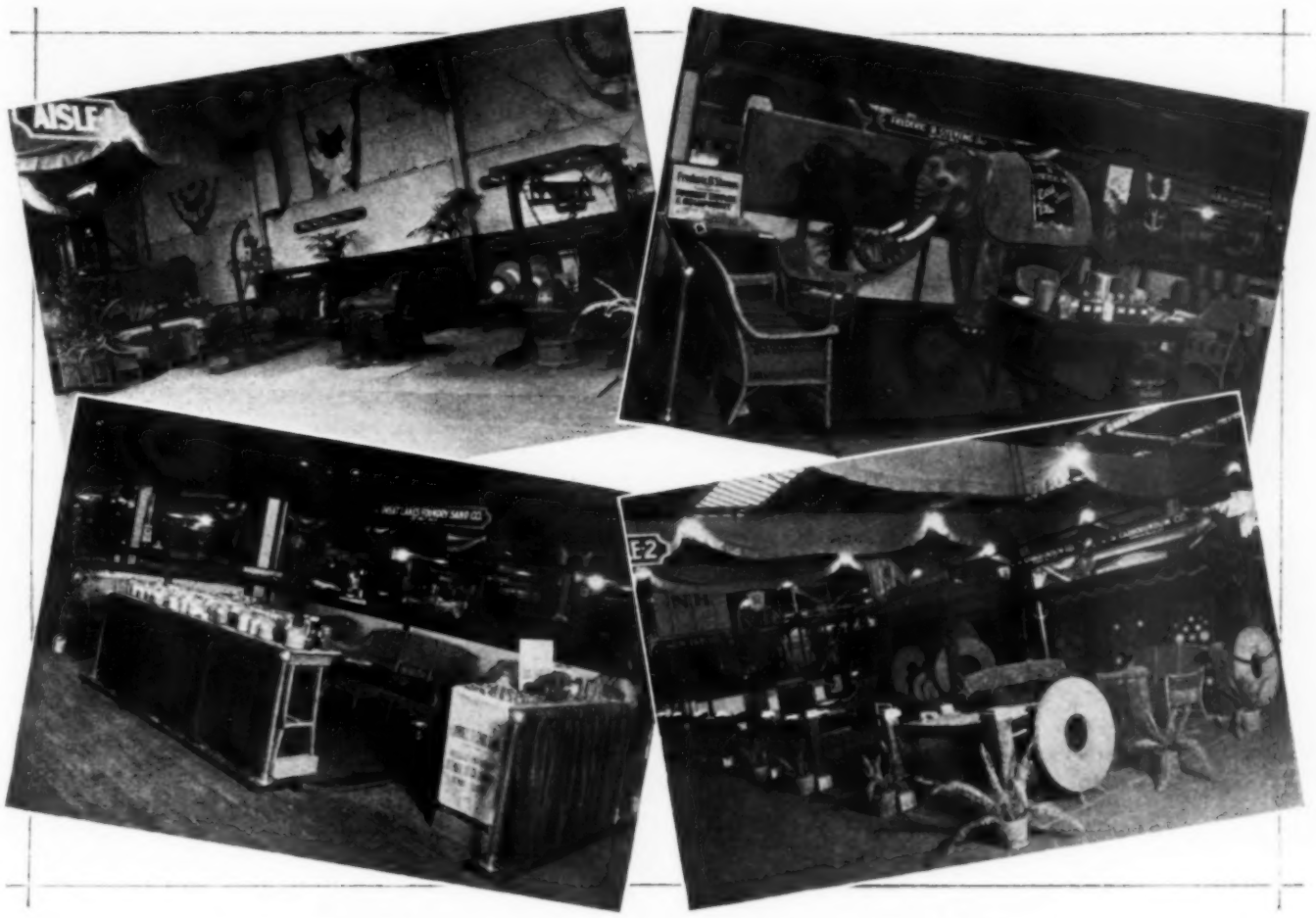
Exhibits Attract Attention

Two operating units in the annex attracted a great deal of attention due to the elaborate display, the extent of the mechanical equipment and the actual foundry atmosphere prevailing. Molds were made as in a regular foundry. In one metal was melted and poured and the castings were shaken out and cleaned as in regular gray iron foundry practice in the most modern foundries. Four foundry equipment manufacturers with booths adjoining, collaborated in one instance and three in another.

The first group included the Osborn Mfg. Co., Cleveland; with a complete sand handling and mold making unit; the Pittsburgh Electric Furnace Corp., Pittsburgh, which supplied the molten iron from a 1000-pound-per-hour furnace; the Cleveland Electric Tramrail division of the Cleveland Crane & Engineering Co., Wickliffe, O., which supplied the monorails and hoists for handling the metal and castings; and the W. W. Sly Mfg. Co., Cleveland, in several of whose extensive line of cleaning devices the castings were cleaned.

In the second installation, similar except that no metal was melted and poured, the Herman Pneumatic Machine Co., Pittsburgh, furnished the

Practically All Types of Foundry Equipment Were on Display at the Various Booths



Novel Displays Could Be Seen in Every Direction in the Exhibition Hall

two molding machines and the shakeout equipment; and the Mathews Conveyor Co., Ellwood City, Pa., supplied the roller conveyor encircling the display. The sand handling equipment was a product of the C. O. Bartlett & Snow Co., Cleveland.

In the complete foundry the electric furnace had a melting capacity of 1000 pounds per hour. The iron was tapped into a bull ladle and then transferred to hand ladles employed in pouring the molds. The hand ladles were suspended from carriers. The mold conveyor was controlled automatically and was set to move forward one space at each 5-minute interval. Five molding machines, each of a different type, were located two on the inside and three on the outside of the conveyor and illustrated the flexibility of the system to accommodate varying outputs from the different machines. The entire outfit was standard and was capable of being extended to any reasonable length.

The molds were poured at the south end of the conveyor near the furnace and were dumped a short distance further along into a submerged conveyor which discharged on to a conveyor traveling upward. Flasks were returned on their respective trays. The castings fell into tote boxes and were carried to several cleaning devices of the W. W. Sly Mfg. Co. The sand was taken through a rejuvenation system and returned to the machine's hoppers.

The W. H. Nicholls Co., Richmond Hill, Long Island, N. Y., showed a large rollover, jolt, squeeze pattern draw machine in which a rack and pinion takes the place of the usual level arrangement for rolling the load. The rack is actuated by an air cylinder and gives positive control over the load at all stages.

Display Molding Machines

An attractively designed rollover machine was among the various models displayed by the Milwaukee Foundry Equipment Co., Milwaukee. In this machine the rolling mechanism was covered under a hood that is said to insure protection from dirt incident to operation. The rolling mechanism can be adjusted for any weight of load and in that manner there is no jump and no danger of the load sticking on a dead center.

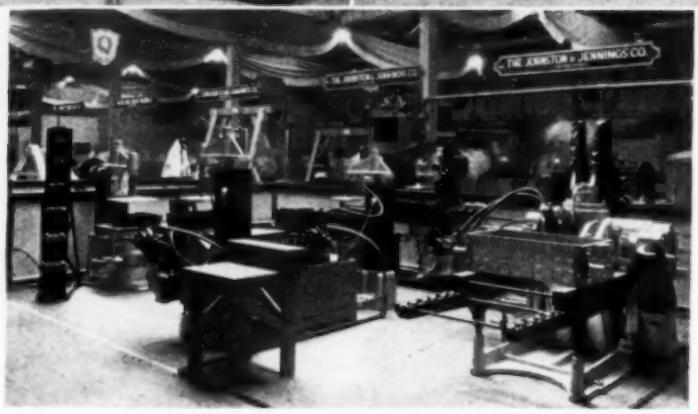
Molding machines in extensive variety, some still and some in operation were displayed by all the molding machine makers including the Adams Co., Dubuque, Iowa; Arcade Mfg. Co., Freeport, Ill.; Champion Foundry & Machine Co., Chicago; Wm. Demmler & Bros., Kewanee, Ill.; International Molding Machine Co., Chicago; Johnston & Jennings Co., Cleveland; Moline Iron Works, Moline, Ill.; Tabor Mfg. Co., Philadelphia.

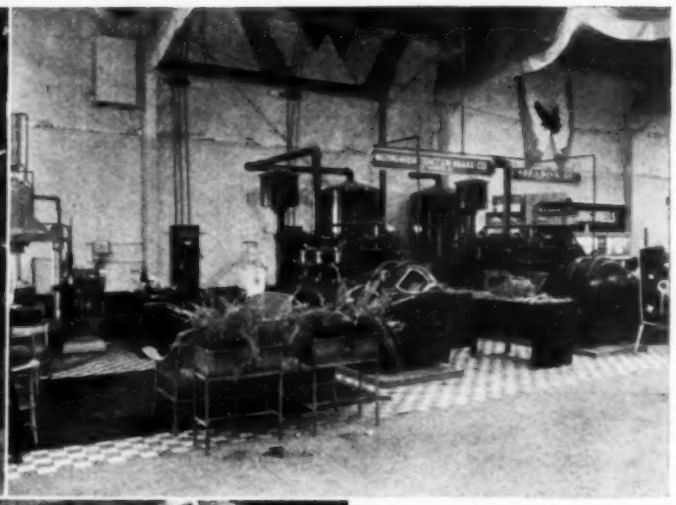
Wadsworth Core Machine & Equipment Co., Akron, O., operated motor driven machines for making, cutting and coning cores. A line of steel bottoms and core plates also was exhibited. Mold and core shakeout equipment, vibrators and a core grinding machine were exhibited at the booth of the Stoney Foundry Engineering & Equipment Co., Cleveland. Vibrators in all styles also were shown at the booth of the Malleable Iron Fittings Co., Branford, Conn.

Various cranes of the span and monorail types were included in the display of handling equipment. The Box Crane & Hoist Corp., Philadelphia had a crane erected in its booth with a lifting capacity of 3 tons. Despite the distance of 7 feet 5 inches from the ground to the top of the rails the unit had a lift of 7 feet 3 inches. The carriage operated in 26 inches of head room. Featuring this company's display was a raw hide rope used on one of its cranes in 1880.

Application of aluminum castings to

Molding and Cleaning Equipment Were Features of the Show





A Compressor Operating Exhibit Attracted Attention

the manufacture of electric crane trolleys was observed at the booth of the Northern Engineering Works, Detroit where the company had in operation a 5-ton 2-motor unit and a 1-ton monorail electric hoist. Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y. showed a cab-type cupola charging hoist and compact electric hoists varying in capacity from 2000 to 6000 pounds. Details involved in the charging of cupolas were shown by the Harnischfeger Sales Corp., Milwaukee, where motion pictures of the operation were featured. A working model of a 10-ton crawling crane also was shown.

Electric driven and hand-power hoists were displayed by a number of makers. The Reading Chain & Block Corp., Reading, Pa. in addition to showing hoists of these types in 500-pound, ½-ton and 1-ton capacities exhibited a traveling crane, a monorail system and trolleys. The booth of the Chisholm-Moore Hoist Corp., Tonawanda, N. Y. featured a 3-ton cupola charging machine and included a display of 1-ton chain blocks, a 2-ton electric hoist and a cut away section of a ½-ton hoist. The Harrington Co., Philadelphia displayed its line of hoists, trolleys, track, switches, turntables, etc.

Monorail hoists with switch control at working level were demonstrated by the Milwaukee Electric Crane & Hoist Corp., Milwaukee. The company's exhibit also included crane trolleys and a single-line bucket. Electric hoists of light and heavy construction were shown by Robbins & Myers Sales Inc., Springfield, O. The application of monorail electric hoists to the foundry industry was depicted by photographs by the American Engineering Co., Philadelphia. The company also had its booth equipped with motor-driven monorail hoists of 500, 2000 and 4000 pounds capacity. The floor in the booth of the Wright Mfg. Co., Bridgeport, Conn. was laid out in 1-foot squares to show the coverage of its overhead cranes.

Conveyors Were Shown

An operating exhibit was conducted by the Mathews Conveyor Co., Ellwood City, Pa., showing the application of conveyors in foundry practice. Molds were conveyed to a shakeout station where the sand was elevated to a vibrating screen and hoppers. The empty flasks in which the drags and copes were made were returned to their respective stations.

Several types of conveyors for handling molds, cores and castings were displayed. Chain Belt Co., Milwaukee showed sand handling and conditioning units, conveyors and other foundry equipment in the form of drawings and photographs. A grease-protected gravity roller conveyor operating in sand comprised the exhibit of the Standard Conveyor Co., North St. Paul, Minn. An installation for feeding sand to two molding machines was demonstrated by C. O. Bartlett & Snow Co., Cleveland. Illustrations of conveying equipment featured the display of the Eastern Corp., New York.

Various type lift trucks were available for inspection. The Baker-Raulang Co., Cleveland, showed battery operated elevating and lift trucks of 3 tons capacity. The Atlas Car & Mfg. Co., Cleveland, in addition to showing a 3-ton lift truck, had its booth equipped with turntables and miscellaneous foundry cars. It also exhibited a dial scale equipped with a self-recording chart. Elevating platform and tier lifting trucks of 3 tons capacity and equipped with spur gear drives were shown by the Automatic Transportation Co. Inc., Buffalo. In addition to hand lift and electric trucks and tractors the Yale & Towne Mfg. Co., Stamford, Conn. showed a new type electric hoist with control mounted in the travel lever and 1-ton electric hoist with a power-driven trolley. Clark Tructractor Co., Battle Creek, Mich. demonstrated an automatic end-dump tractor equipped with a 30-cubic foot body and a gas propelled oven charger and digger.

A model consisting of 18 pendants for conveying molds featured the ex-

hibit of the Palmer-Bee Co., Detroit. A vibrating screen shakeout and a large mold conveyor were operated by the Link-Belt Co., Chicago. The company also showed handling and conveying equipment of the roller type and power transmission chains, the latter being mounted on a display board. A model of a bridge, clam-shell bucket and take-up reel was in operation at the booth of the Hayward Co., New York.

Overhead monorail conveying equipment, cranes, hoists, lifts and containers comprised the exhibit of the American Monorail Co., Cleveland. An overhead conveyor system was shown in operation by Jervis B. Webb Co., Detroit. Included in the exhibit of the Louden Machinery Co., Fairfield, Iowa, was monorail equipment and a motor-driven unit with a step-on cab.

The Pangborn Corp., Hagerstown, Md., had a large display of cleaning and dust collecting equipment. The firm exhibited a new type automatic rotary table sandblast, an automatic continuous pressure tank, sandblast barrels, a core knockout machine of the hydraulic type, a moisture and oil separator and a new abrasive separator for separating sand and foreign materials from the abrasive. The New Haven Sand Blast Co., Cleveland, showed a sandblast room with a dust arrester attached, a direct pressure sandblast barrel, a radial type sandblast barrel and a roller bearing tumbling mill.

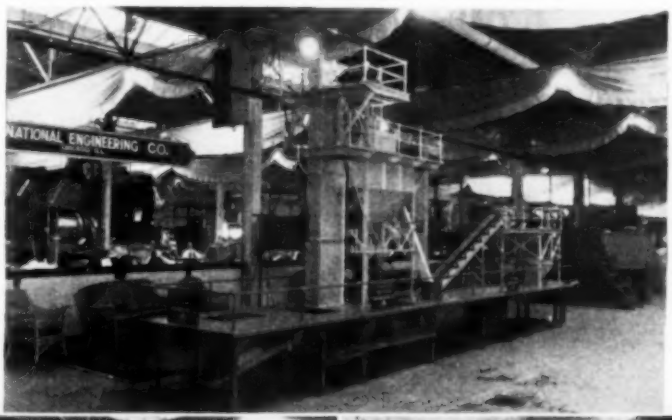
Operating exhibits of the American Foundry Equipment Co., Mishawaka, Ind., included sand cutters, sandblast and dust arrester equipment and sand throwing apparatus for reconditioning sand. The firm also maintained a separate booth to display its flasks and jackets, core machines, rod straighteners, shear machines and unit heaters for industrial plants. The Ruemelin Mfg. Co., Milwaukee, showed a sandblast cabinet attached to dust arresting equipment, a sandblast generator, sandblast guns, operators' helmets, moisture and oil separators, and sandblast nozzles. Gravity barrel and hose-type sandblast machines, a model of its dust arrester and a portable oil burner for cupola lighting, were featured by the Macleod Co., Cincinnati. N. Ransohoff Inc., Cincinnati, exhibited a star-return tumbling barrel.

Operate Grinding Exhibits

Grinders for every purpose were shown by a large number of firms and included floor stand, swing, and portable types. The United States Electrical Tool Co., Cincinnati, displayed a disk-drive, variable speed grinder and buffer, and several double wheel floor stand grinders. The Norton Co., Worcester, Mass., featured two swing grinders and one stand grinder in operation. Grinding wheels and other abrasives also were shown. The Hisey-Wolf Machine Co., Cincinnati, showed several 2-wheel floor-stand grinders, grinding machines and portable grinders. The Kling Bros. Engineering Works, Chicago, had heavy-duty, high-speed grinders on display. Cyril A. Fox, Pittsburgh, showed a swing frame grinder and a heavy-duty stand grinder attached to an exhauster in operation.

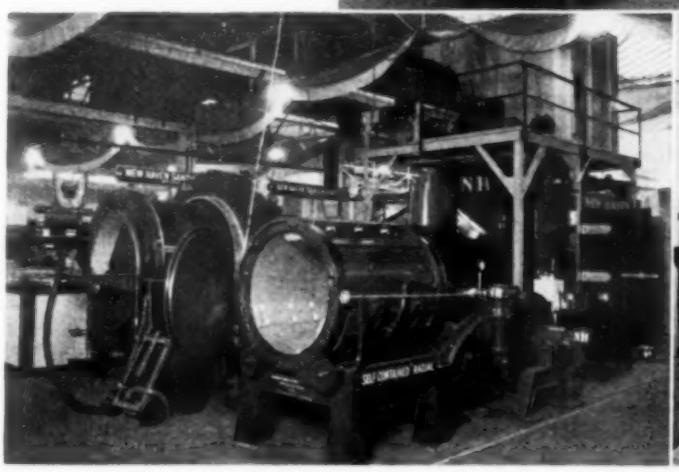
Grinding equipment featured the exhibit of the Van Dorn Electrical Tool Co., Cleveland. Speeds of 10,500 surface feet per minute are claimed for the equipment. Flexible shaft equipment for grinding, sanding, and metal finishing was shown by the Mall Tool Co., Chicago. Black & Decker Co., Towson, Md., featured a pedestal type grinder, a wide wheel grinder, a tool grinder, and normal and high speed production grinders. Marschke Mfg. Co., Towson, Md., a subsidiary of Black & Decker had three swing grinders in operation. Other grinding equipment made by the firm was shown. Motor driven floor stand grinders, portable swing frame grinders and medium and high speed grinding wheels were shown by the Safety Grinding Wheel & Machine Co., Springfield, O.

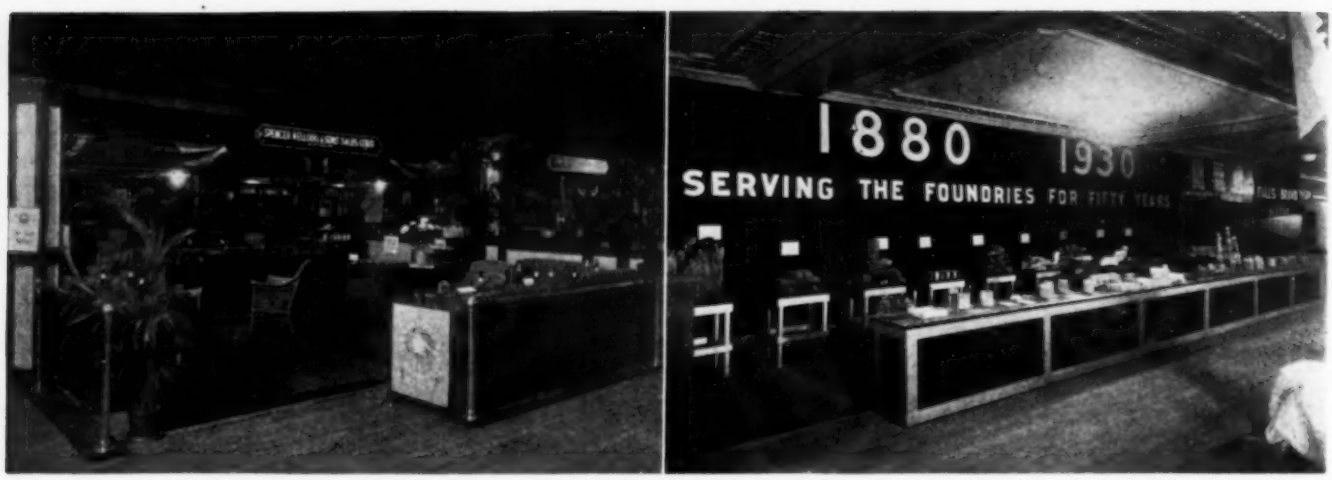
Several manufacturers of pneumatic tools exhibited equipment adapted for the foundry industry. The Rotor Air Tool Co., Cleveland, displayed its line of portable pneumatic grinders, buf-



A Model Sand Handling and Reclaiming System Was Shown

A Large Portion of the Space Was Devoted to Equipment





All Available Space in the Arena Was Utilized as Exhibition Space by Supply Manufacturers and Non Operating General Exhibits

fers, sanders and drills. It also showed a new type of buffer for light sanding operations. The Buckeye Portable Tool Co., Dayton, O., featured a new type of drill having a portable and adjustable stand, and a new sander and cup wheel grinder with a governor controlled rotor. The Dayton Pneumatic Tool Corp., Dayton, O., exhibited sand rammers, chippers, riveters, chisel blanks and hose connections.

Many Abrasives Displayed

The Carborundum Co., Niagara Falls, N. Y., had an attractive display of grinding wheels of various diameters and thicknesses, and abrasive disks. The Sterling Grinding Wheel Co., Tiffin, O., exhibited a swing grinder in operation and a line of its grinding wheels. The Manhattan Rubber Mfg. Co. division of Raybestos-Manhattan Inc., Passaic, N. J., showed its high speed, rubber bonded, grinding wheels. Through co-operation of the Kling Bros. Engineering Co., Chicago, and Cyril A. Fox, Pittsburgh, the wheels were in operation on machines manufactured by those firms. Steel and malleable castings were being cleaned by wheels exhibited by the Abrasive Co., Philadelphia. The wheels were mounted on swing-frame, portable and floor stand grinders. The Precision Grinding Wheel Co. Inc., Philadelphia displayed a number of different type wheels it manufactures. These included vitrified silicate, bakelite, rubber and shellac bonded wheels. Metallic abrasives were featured by several firms including the Globe Steel Abrasive Co., Mansfield, O.; the American Steel Abrasives Co., Galion, O.; Patch-Wegner Co. Inc., Rutland, Vt., and the Steelblast Abrasives Co., Cleveland.

Oxygen, acetylene and oxyacetylene welding and cutting equipment were displayed by the Linde Air Products Co., New York, and the Air Reduction Sales Co., New York. The Linde company included a manifold for connecting several tanks together in its exhibit and the Air Reduction company showed one large machine and two smaller ones for cutting steel automatically. The General Electric Co., Schenectady, N. Y., exhibited electric welding equipment, motors, control equipment, and its cupola blowers. The cupola blowers were equipped with a regulating device to insure a constant weight of air.

The Whiting Corp., Harvey, Ill., had two operating exhibits in its booth. One was a cupola charging device which consisted of a brick-lined section of a cupola with a crane runway on which the charger operated. The firm also had a tumbling barrel attached to a dust arrester in operation, a unit pulverizer for powdering coal, ladles and charging buckets, and a model of a powdered-coal-burning, rotary furnace.

Manufacturers of melting furnaces, ovens and the accessory equipment which these units require, such as, refractories, compressors, blowers and metal handling devices comprised an interesting and important classification of exhibitors. Detroit Electric Furnace Co., Detroit, exhibited a rocking type electric furnace of 740 to 1000 pounds capacity, complete with accessory electrical equipment. A number of types of melting furnaces also were displayed by the Monarch Engineering & Mfg. Co., Baltimore. This company also displayed core ovens, ladle heaters, sand mixers and similar equipment. Metal melting furnaces for gas or oil fuel were shown at the booth of Campbell-Hausfeld Co., Harrison, O.

A number of types of core ovens were exhibited by Foundry Equipment Co., Cleveland. One was a large vertical conveyor type oven, completely equipped and ready for operation. Others were rolling drawer ovens, transfer rack ovens, and portable ovens. Young Brothers Co., Detroit, also exhibited core ovens, one of which was an electrically heated test oven. A model of a continuous conveyor type core oven was shown, also a coke fired heater for foundry ovens. Heaters of the unit convection type for gas and oil fired core and mold ovens were features of the exhibit of Paul Maehler Co., Chicago. This company also had arranged drawings and photographs of heaters and ovens which it manufactures.

Core, mold, japanning and enameling ovens, indirect heating equipment for industrial ovens, and rod baking and low temperature heat treating ovens comprised the display of Drying Systems Inc., Chicago.

Features Pouring Devices

A complete display of hot metal handling and transportation was featured by Modern Pouring Device Co., Port Washington, Wis., whose exhibit contained a wide range of pouring devices, both hand and mechanically operated. Turbocompressors were shown by Spencer Turbine Co., Hartford, Conn., two types being exhibited; one for supplying air to cupolas and the other to be used in connection with gas or oil fired furnaces. Grindle Fuel Equipment Co., Harvey, Ill., had erected for inspection a unit pulverizer complete with feeder, blower, piping and pulverized coal burner.

Refractory materials were exhibited by a number of manufacturers, including the Carborundum Co., refractory division, Perth Amboy, N. J., showing a variety of refractory brick, shapes and a high temperature cement. A special feature of this attractive exhibit was a model of a furnace recuperator mounted on a base consisting of special recuperator tubes assembled complete with corebusters and terminal wall blocks.

Refractories for cupolas, bessemer

linings, soaking pits and drop forge bottoms were displayed by Cleveland Quarries Co., Cleveland, as well as samples of malleable furnace bottom sand marketed by the company. Mt. Jewett Fire Clay Co., Mt. Jewett, Pa., showed fire clay for general foundry purposes, clays for bonding molding sands and a special high temperature cement. Special refractories for gray iron, brass, steel and aluminum foundry practice formed the display of the John L. Cummings Co., St. Joseph, Mich.

A variety of miscellaneous items such as parting, high temperature cement, core oil, flask pins, core compound, core paste, etc., was contained in the exhibit of Buckeye Products Co., Cincinnati. Samples of buffing compositions which the company distributes also were featured. Graphite crucibles, stoppers, nozzles, sleeves, clay refractory nozzles, combination nozzles, clay refractory sleeves, refractories, graphite facing and core washes made up the list of products displayed at the booth of the Joseph Dixon Crucible Co., Jersey City, N. J. Graphite crucibles and graphite stoppers also were exhibited by Vesuvius Crucible Co., Swissvale, Pa.

Show Sand Equipment

Makers of sand handling and conditioning equipment were well represented at the exhibit. The Royer Foundry & Machine Co., Wilkes-Barre, Pa., exhibited the separators and blenders and a new piece of equipment designed to separate scrap from the sand. The new apparatus is capable of handling 800 pounds of sand and scrap per minute. The blenders displayed varied in capacities from 500 to 2000 pounds per minute.

Gyratory riddles were shown by the Lowe Mfg. Co., Detroit, and the Great Western Mfg. Co., Leavenworth, Kan. The latter operated two machines of 36 and 20-inch diameter respectively and a laboratory sand sifting apparatus with a capacity for 16 screens. The former showed several types of gyratory riddles. The Blystone Mfg. Co., Cambridge Springs, Pa., showed a direct motor driven paddle type sand mixer.

Deister Concentrator Co., Fort Wayne, Ind., showed several types of foundry screens. One type was equipped with a grizzley and the others were used in connection with a sand blender and thrower and a muller type sand mill. Productive Equipment Corp., Chicago, displayed various types of foundry screens. Niagara Concrete Mixer Co., Buffalo, also showed a sand screen. The Clearfield Machine Co., Clearfield, Pa., had a bucket type loader and a sand mill on display. Universal Sand Equipment Co., Cleveland, exhibited sand throwers of various capacities and a sand hopper with a lever type discharge.

The Newaygo Engineering Co., Newaygo, Mich., had a machine on display for crushing cores, cupola slag, etc. The apparatus was driven by a 5-horsepower induction motor and was designed somewhat on the order of a jaw crusher. National Engineering Co., Chicago, had a model sand handling and conditioning system in operation. This model illustrated the handling of sand from the shakeout to the molding machines. The company also had a full size muller type sand mixer on display.

One of the most attractive booths in the exhibition hall was that of the Ajax Metal Co., Philadelphia. This company is celebrating its fiftieth anniversary and arranged a series of mileposts in front of its booth indicating its progress. Part of its booth is used by the Ajax Electrothermic Corp., Trenton, N. J. for display of its induction type electric furnaces.

Truscon Steel Co., Youngstown, O., exhibited a line of foundry flasks, core plates, bottom boards, boxes, platforms and other supplies. H. L. Baumgardner Mfg. Corp., Fremont, O., also showed slip flasks with aluminum jackets. Hines Mfg. Co., Cleveland, exhibited in conjunction with the Baumgardner company.

Core binders and facings were shown by several companies. J. S. McCormick Co., Pittsburgh, had facings, core binders, chaplets, plumbagoes, etc. in its booth while the Kelly Graphite Mills Inc., Stockertown, Pa. showed samples of work done as well as its three types of facings.

Oiless Core Binder Co. displayed a series of block tests showing the possibilities of coring heavy metals with small cores. It also had a locomotive casting weighing about 18,000 pounds and a header bed of about 16,150 pounds. Core binders, core paste, etc. also were exhibited by this company. Asbury Graphite Mills, Asbury, N. J. had a display of graphite as used for foundry purposes.

Operates Pattern Tools

Pattern shop and grinding equipment formed an important part of the foundry accessories displays. Biax Flexible Shaft Co. Inc., New York, exhibited flexible shaft grinders, rotary files, track grinders, stand grinders, etc. R. G. Haskins Co., Chicago, also displayed flexible shaft equipment for grinding, wire brushing, polishing and sanding. Woodworking equipment including a wide variety of saws and sanders was shown in the booth of the Oliver Machinery Co., Grand Rapids, Mich. A combination cross cut and rip saw for pattern shops, jointer and metal cutting saw were exhibited by DeWalt Products Corp., Lancaster, Pa.

Kindt-Collins Co., Cleveland, showed

Sands and Binders Were Shown at Many of the Booths in Various Parts of the Arena and Capacious Rest Facilities Were Provided for the Numerous Visitors

two table saws, a band saw, a pattern shop lathe, and a single and double aluminum melting furnace. Precision saw tables for patternmakers featured the exhibit of John Royle & Sons, Paterson, N. J. S. Obermayer Co., Chicago, displayed high temperature cements and refractories for furnaces, as well as other foundry supplies.

Lumber for pattern shops was displayed by White Pine Lumber Co., Chicago and Cleveland, and the Sugar Pine Pattern Lumber exhibit. The latter, an exhibit of seven California companies featured a plank 6 inches thick and 42 inches wide, cut from a California sugar pine tree ten feet in diameter and 250 feet high.

Sand testing and control equipment were exhibited by Harry W. Dietert, Detroit. Equipment for sand testing was featured by R. W. McIlvaine Co., Chicago. Sand testing sieve shakers and standard screen scale testing sieves and woven wire cloth were included in the display of W. S. Tyler Co., Cleveland.

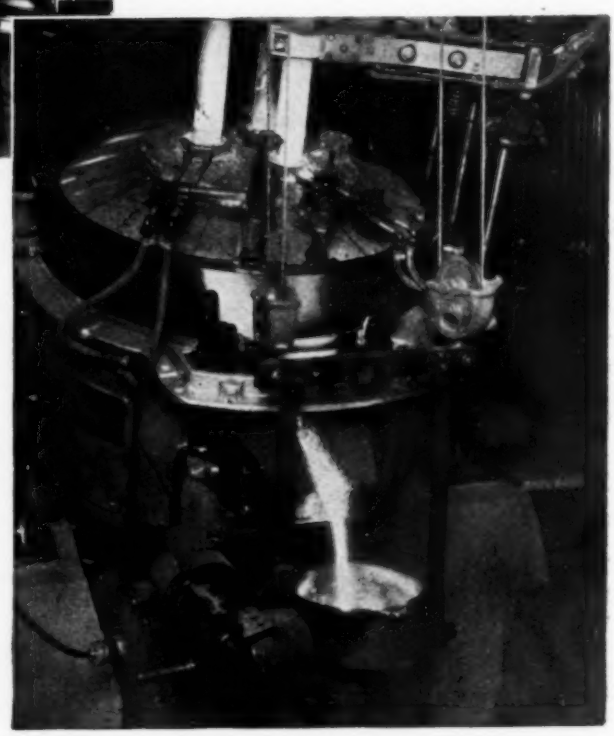
Paket Alloys Inc., New York, showed silicon and manganese-silicon briquets for gray iron. A line of foundry flask pins and bushings were exhibited by Michigan Screw Co., Lansing, Mich. The Reeder Mfg. Co., St. Louis, showed nonchillable chaplets and brass chill ribs or cracking strips of various types.

W. A. Jones Foundry & Machine Co., Chicago, exhibited a line of spur, worm and herringbone speed reducers in operation. Saginaw Stamping & Tool Co., Saginaw, Mich., operated an overhead conveyor of the hook type and also the tramrail type for conveying larger articles.

Smith-Monroe Co., South Bend, Ind., displayed a line of air separators for removing foreign substances from compressed air lines. Shields for grinding wheels, safety protection, clothing, goggles, etc. were shown by Standard Safety Equipment, Chicago.

A variety of nonoperating exhibits were shown in the arena. Core oils were displayed by Spencer Kellogg & Son Sales Corp., Buffalo; Werner G. Smith Co., Cleveland; Dayton Oil Co., Dayton, O.; Tiona Petroleum Co., Philadelphia; Smith Oil & Refining Co., Rockford, Ill. and the Pennsylvania Lubricating Co., Pittsburgh. The booth of the Spencer Kellogg company showed many different types of cores made from the core oils that the company manufactures. Cores included those used in motors, furnaces, stove and radiator castings. Various grades of core oils also were on display. Werner G. Smith Co. exhibited various type cores for aluminum, brass, bronze and gray iron castings. Cores and castings produced from them were located side by side in the display. Dayton Oil Co. and the Smith Oil & Refining Co. showed samples of their various core oils and cores made from them. The Tiona Petroleum Co. also exhibited core oils and in addition displayed metal cutting lubricants. Pennsylvania Lubricating Co., Pittsburgh. in addition to displaying its line of core oils, had its booth equipped with a wide assortment of cores made with its oils. Flour core binders were exhibited by several companies. Knefler-Bates Co., Indianapolis, had products of its core binders on display. One of the interesting features of the exhibit was an explanation of how these binders are manufactured. Corn Products Co., New York, and the Advance Milling Co., Chicago, had interesting displays illustrating the various cores produced from the binders that they manufacture. H. E. Mills Mfg. Co., Syracuse, N. Y., showed dry core compounds and aluminum crankcase and transmission castings in which the various cores used were made with its core compound. American Gum Products Co., New York and the Robeson Process Co., New York, both displayed their products in the same booth. These displays featured core binders and cores in which the binders were used.

Safety clothing makers were well represented. These included the Safety Equipment Co., Cleveland; Bullard-Davis Inc., New York; Safety Clothing Co., Cleveland; and the Safety First Shoe Co., Framingham, Mass. Safety Clothing Co. and the Bullard-Davis Inc., shared a booth where first aid kits, inhalators, gas masks, gloves, leggings, mittens, spats and other asbestos duck safety clothing were on display. The Safety Equipment Service Co., had on exhibition asbestos suits, goggles, sandblast suits and aprons, fire resisting suits, gloves, mittens, safety shoes, etc. Safety First Shoe Co. displayed various types of safety shoes for men employed in the foundry industry.



(Above)—Molders Working in the Combination Exhibit Which Melted the Metal, Made the Molds, Poured the Molds, Cleaned the Castings and Transported the Molten Metal and Resultant Castings. (Right)—Metal Tapped From the Electric Furnace

A paster, chaplets and cast-aluminum pattern plates were displayed by the Combined Supply & Equipment Co. Inc., Buffalo. Welded bottom boards in various sizes and shapes, clusters of cast valves and pipe fittings, core and pattern plates, etc. were shown by the Moltrup Steel Products Co., Beaver Falls, Pa. Tapered flasks built of cherry wood and aluminum and equipped with various types of pin equipment and automatic adjustable jackets were included in the display of T. B. Wood's Sons Co., Chambersburg, Pa.

Flask Equipment Shown

An assortment of foundry flasks made of aluminum, malleable iron and cast steel in round and rectangular shapes were exhibited by the Hines Mfg. Co., Cleveland. In addition to white iron and semisteel castings shown by the American Brake Shoe & Foundry Co., Chicago, plates and stools and white iron annealing boxes of the open and closed types and with and without stools also were displayed. United Compound Co., Buffalo, had various sizes of vent wax on display.

The part that X-ray is playing in the examination of castings was depicted by the General Electric X-Ray Corp., Chicago. Kelley-Koett Mfg. Co. Inc., Covington, Ky. showed films and illuminators in addition to X-ray diffraction and radiographic equipment. Bausch & Lomb Optical Co., Rochester, N. Y. exhibited such instruments as microscopes used for metallographic purposes, microscopes of the wide field and binocular types and optical measuring instruments. Heat recording instruments were shown at the booth of the Pyrometer Service & Supply Corp., Cleveland.

Methods of mounting patterns using a special compound was demonstrated by the Stone Pattern Mount Co. Inc., Bloomfield, N. J. Pattern letters, numerals and trade marks made of white metal and brass were on view at the booth of H. W. Knight & Son, Seneca Falls, N. Y.

One of the features of the exhibits of firms manufacturing foundry supplies was the booth of Frederic B. Stevens Inc., Detroit. That booth contained an animated, life-sized elephant portraying the trademark of the company. The firm also showed steel ladles of various sizes and samples of its blackings, parting and plumbago. The Federal Foundry Supply Co., Cleveland, exhibited a group of sand testing devices including a permeability machine and a sand strength testing machine. The firm also showed a gyratory riddle, hand riddles, flask pins and guides and samples of its facings and foundry supplies. Demonstrations of rebonding burned sand with a bonding clay supplied by the company also were made.

Rogers, Brown & Crocker Bros. Inc., Cincinnati, celebrating its golden anniversary, had a large display of pig iron, coke, ferroalloys, fluorspar, molding sand and fireclays. The firm also exhibited a line of aluminum alloys in ingot form. Pickands, Brown & Co., Chicago, showed a variety of castings made with pig iron the firm supplies. Castings included were automotive, marine and air cylinders, small gears, gas burners and plate castings. The Chateaugay Ore & Iron Co., New York, exhibited machine-cast, copper-free, low-phosphorus pig iron; low phosphorus concentrates and sintered iron ore. The Bethlehem Steel Co., Bethlehem, Pa., showed a number of castings of different sizes and shapes made from pig iron it supplies, and samples of the pig iron. Castings included airplane and automotive cylinders, brake drums, diesel engines, pistons, pots and pans.

Accessories Are Displayed

A line of plastic, hot set and cold set cements, patching materials and monolithic refractories, etc., were shown by the North American Refractories Co., Cleveland. The company also displayed a model of a malleable furnace bottom, and foundry refractories. The Ironton Fire Brick Co., Ironton, O., exhibited cupola blocks, fire bricks and firebrick shapes, malleable bungs and plastic refractory cements. The Electro Refractories Corp., Buffalo, exhibited crucibles and special refractories for foundry use. The Chicago-Naugatuck Crucible Co., Chicago, displayed various sizes of graphite crucibles for steel, brass, bronze, monel and other metal melting. The firm also showed silicon carbide and clay crucibles. Graphite crucibles, rest blocks, furnace covers and linings for crucible, open flame and electric furnaces featured the exhibit of the Lava Crucible Co. of Pittsburgh, Pittsburgh. The company also displayed furnace cements and refractories made in special shapes.

Exhibits Facings

The Superior Flake Graphite Co., Chicago, exhibited samples of its plumbago and parting compound. The Smith Facing & Supply Co., Cleveland, showed its line of facing materials and several cores and castings on which the facings are used. The United States Graphite Co., Saginaw, Mich., displayed graphite, plumbago and core washes.

The Semet-Solvay Co., New York, displayed a large group of castings of various sizes and thicknesses which were made with its coke. The castings included a 16-cylinder automobile motor, bottle molds, gate valves, etc. Several views of castings and foundries in which the firm's coke is used also were displayed. The International Nickel Co., New York, exhibited a large casting weighing 10,000 pounds and a small one weighing 11 ounces to show the application of nickel to cast iron. Use of nickel in nonferrous metals also was shown.

J. E. Dockendorff & Co. Inc., New York, in connection with its display of aluminum alloy ingots, had a novel display of uses of aluminum. These included aluminum coated wallpaper in colors; thin aluminum foil with variegated colors, and enameled aluminum ware similar in appearance to the regular colored ceramic ware. The firm also showed aluminum alloy castings made in sand and permanent molds. Alloys & Products Inc., New York, displayed samples of its nonferrous shot alloys, and manganese bronze, aluminum bronze, nickel silver and aluminum alloy ingots. The

One Large Booth in the Annex Was Devoted to a Display of Nonferrous Ingots and Electric Furnaces

Niagara Falls Smelting & Refining Corp., Buffalo, had a joint exhibit of its aluminum alloys, brass foundry alloys, and special alloys for nonferrous mixtures with the Rogers, Brown & Crocker Bros. Inc. The British Aluminum Co. Ltd., New York, displayed virgin and alloy aluminum ingots, and castings made from these metals in sand, permanent molds and dies. The castings included pots and pans, vacuum cleaner castings, washing machine agitators, etc.

Illustrations were used by the Austin Co., Cleveland, and Frank D. Chase Inc., Chicago, in demonstrating the engineering services which they render. The Austin Co. also showed a tractor the castings for which were made in the new modern foundry featured in its illustrations. The Chase organization exhibited plans and pictures of various kinds of buildings which it has designed and constructed.

A 1-yard grab bucket featured the booth of the G. H. Williams Co., Erie, Pa. Blaw-Knox Co., Pittsburgh, demonstrated a single line, foundry-type clamshell bucket, steel grating, steel armoring for floors and steel stair treads for foundries.

Exhibit Variety of Products

Two new models of pyrometers, designed especially for obtaining temperatures of brass, bronze and copper while still in the furnace, featured the exhibit of the Illinois Testing Laboratories Inc., Chicago.

Wilbraham-Green Blower Co., Pottstown, Pa., division of Connersville Blower Co., Connersville, Ind., showed a high-duty cupola blower equipped with volume reducing and indicating mechanism.

A line of foundry flasks was exhibited by the Sterling Wheelbarrow Co., Milwaukee. Other foundry products manufactured by the company also were on display.

Holcroft & Co., Detroit, showed photographs and drawings of ovens and furnaces for heat treating, annealing and foundry uses. Charts and blue prints of installation of hot blast cupolas were part of the display of Griffin Engineering Co., Chicago.

Sand supply companies were well represented and the exhibits included molding, core and silica sands for gray iron, malleable, steel and nonferrous molding and coremaking. Clays for rebonding molding sands also were shown. Firms having displays included the Albany Sand & Supply Co., Albany, N. Y.; Ayers Mineral Co., Zanesville, O.; Cleveland Quarries Co., Cleveland; Eastern Clay Products Inc., Buffalo; Federal Foundry Supply Co., Cleveland; Great Lakes Foundry Sand Co., Detroit; Greenite Co., Buffalo; Houghland & Hardy, Evansville, Ind; Illinois Clay Products Co., Joliet, Ill.; Industrial Minerals Co., Columbus, O.; Industrial Silica Corp., Youngstown, O.; Keener Sand & Clay Co., Columbus, O.; Mt. Jewett Fire Clay Co., Mt. Jewett, Pa.; New Jersey Silica Sand Co., Millville, N. J.; Peerless Sand Co., Conneaut, O.; George F. Pettinos, Philadelphia; Rogers, Brown & Crocker Bros. Inc., New York; Sand Products Corp., Detroit; Eugene W. Smith Inc., Evansville, Ind.; Standard Silica Co., Chicago; Superior Sand Co., Cleveland; Tuscora Sand & Coal Co., Cleveland; Warner R. Thompson Co., Detroit; Whitehead Bros. Co., Buffalo; White Rock Silica Co., Chicago; and the Zanesville Sand Co., Zanesville, O.

One of the features of the exhibition of the American Foundrymen's association was the displays of the co-operating associations and groups, and the engineering schools which include foundry courses in their curricula. These displays were located in the arcade joining the auditorium and the annex, and showed the work being done to advance the art of founding. The United States department of commerce including the bureau of standards showed some of its work on deoxidizing steel; enameling cast iron and shrinkage of metals and alloys. The Gray Iron institute, Cleveland, showed examples of various types of castings with charts giving strength data on gray iron and the activities of the society. The exhibition of the Malleable Iron Research institute, Cleveland, included charts showing the qualities of malleable cast iron, and the American Society for Testing Materials, Philadelphia, distributed literature on its activities.

Charts Show Activities

Charts covering the activities of the society in raw materials, costs, employment and business featured the booth of the Steel Founders' Society of America Inc., New York. The National Founders association, showed charts and publications of the organization. The American Society of Mechanical Engineers and the American Standards association showed samples of their publications and described the work that they are doing. Safety posters issued by the National Safety council, Chicago, featured its booth. Pamphlets describing their activities were distributed by the Foundry Equipment Manufacturers association, Cleveland, and the Ohio Foundries association, Cleveland.

Castings and patterns ranging from simple test blocks to intricate castings for a marine engine featured the displays entered by a number of engineering and trade schools. Educational institutions having exhibits included the Georgia School of Technology; Ohio State university; University of Nebraska; Carnegie Institute of Technology; Rose Polytechnic institute; University of Iowa; University of Michigan; University of Illinois; Purdue university; Michigan State college; University of Pennsylvania; University of North Dakota; Agricultural and Mechanical College of Texas; Cornell university, Louisiana Polytechnic institute, Cleveland Foundry Trade school, and the Rochester, N. Y. Trade school.

French Founders Hold Election of Officers

At the annual general meeting of the Association Technique de Fonderie de Paris, which took place in Paris, March 20, the following officers were elected: President, Andre Damour, president of the board of directors, Fonderies de Bayard et St.-Dizier; first vice president, Jules Cury, Deville; vice presidents, E. Dady, president of the Association Amicale et Mutuelle de Fonderie, Paris; J. Derdinger, honorary president of the Chambre Syndicale des Fondeurs en Cuivre et Bronze (copper and bronze founders); H. Magdelenat, managing director, Societe des Usines de Rosieres, Bourges; C. Masson, managing director, Societe Mecanique Moderne, Nancy; L. Montupet, managing director, Fonderies Montupet, Paris; E. Ronceray, director of the high school of foundry, Thiais; H. Sandre, managing director, Societe Metallurgique du Perigord, Paris; foreign vice presidents, L. Brasseur, Luxemburg; J. M. Espana, Spain; J. Leonard, Belgium; C. Vanzetti, Italy; general secretary, C. Koelher, managing director, Societe des Fonderies de St.-Ouen, Seine; treasurer, A. Lardin, manager, Etablissements Lardin et Cie., Paris. The registered office of the association has been transferred to 20, Rue Richer, Paris (9e).

Vote Name Change

The name of the Ohio Electric & Controller Co., Cleveland was changed to the Ohio Electric Mfg. Co. at a recent meeting of the stockholders. The main office and plant of the company is located at 5900 Maurice avenue.

The name of the crane manufacturing division of the H. D. Conkey & Co., Mendota, Ill., has been changed to the Conco Crane & Engineering Works division of the H. D. Conkey & Co.

C. S. Anderson *Fred Erb* *D. M. Scott* *R. M. Maull* *H. R. Culling*

Elects New Directors

ANNOUNCEMENT of the election of five members to the board of directors of the American Foundrymen's association was made at the opening business session of the association at Cleveland, Monday, May 12. The following men were elected for a three-year period: C. S. Anderson, vice president and general manager, Belle City Malleable Iron Co., Racine, Wis.; H. R. Culling, vice president, Carondolet Foundry Co., St. Louis; Fred Erb, president, Erb-Joyce Foundry Co., Detroit; R. M. Maull, treasurer and sales manager, Tabor Mfg. Co., Philadelphia; and D. M. Scott, vice president in charge of manufacturing, Gould Coupler Co., Depew, N. Y., and the Symington Co., Rochester, N. Y.

Past President Elected

Fred Erb, retiring president of the American Foundrymen's association was born in 1886 in Royal Oak, Mich. He was graduated from the University of Michigan, Ann Arbor, Mich., in 1908 with a degree of B. S. in mechanical engineering.

Mr. Erb started his industrial career in 1908 with the Detroit Foundry Co. He commenced as a member of the cupola charging crew, but gradually assumed more responsible positions. He was promoted to the position of foundry superintendent within a comparatively short time and later was appointed manager. He resigned from this position in 1913 to assist in organizing the Lakeside Foundry Co., Detroit. Shortly afterward he accepted a position with the Elmira Foundry Co., Elmira, N. Y., but his interests in Detroit and Royal Oak prompted his return after a short period. Soon after his return he was appointed foundry superintendent of the Packard Motor Car Co., and in 1920 he was advanced to the position of manager of the foundry division. He resigned from this position in 1925 to become president of the newly organized Erb-Joyce Foundry Co., with a plant at Vassar, Mich., and executive offices in Detroit. From 1920 to 1926 he served on the board of directors of the American Foundrymen's association. He was elected vice president in 1928 and president in 1929.

C. S. Anderson

C. S. Anderson was born in Racine, Wis., and educated in the public schools of that city. He first entered industry as a clerk in the office of J. I. Case Co., where he remained for two years, 1907-09. In the latter year, he moved to the Mitchell-Lewis Wagon plant and when that company was merged with the Mitchell Motor Car Co., he was transferred to the latter office in charge of the cost department. In 1913 he joined the Belle City Malleable Iron Co., as secretary and treasurer and shortly afterward was made general manager. For the past four years he has combined the offices of vice president, secretary and general manager.

H. R. Culling

H. R. Culling was educated in Dundee, Scotland, and came to the United States in 1889. In the following year he secured a position as shipping clerk at the plant of the Carondelet Foundry Co. Three years later he was promoted to the position of assistant superintendent and in 1900 he became superintendent of the plant. He was elected secretary of the company in 1907 and a few years later, in 1913 he was appointed vice president and general manager, a position which he has retained up to the present. He has served as chairman of the St. Louis Foundrymen's association and now is chairman of the St. Louis District Foundrymen's club.

R. M. Maull

R. M. Maull was born in Philadelphia, Dec. 25, 1887. He was educated in the public schools of that city and as a boy, in 1901, he entered the service of the Tabor Mfg. Co. He has remained with that company ever since and has held various positions in the accounting and business departments. He was cashier, and assistant treasurer before his advancement to his present position of treasurer and sales manager of the Tabor Mfg. Co.

D. M. Scott

D. M. Scott, elected to the board of directors of the American Foundrymen's association, received his scholastic training at Pennsylvania State college, State College, Pa., and Carnegie Institute of Technology, Pittsburgh. He was graduated from the first with the mining engineering class of 1908 and from the second with the metallurgical engineering class of 1912. He was connected with the Pittsburgh and Thurlow, Pa., works of the American Steel Foundries from 1912 to 1916. The following two years he spent with the Canadian Steel Foundries at the Montreal and Welland works. Following a year at the plant of the Jones & Laughlin Co., Pittsburgh, he entered the service of the Symington Co., Rochester, N. Y., in 1920 and has remained with that company up to the present, as vice president in charge of manufacturing. In 1925 he assumed the same position with the Gould Coupler Co., Depew, N. Y.

Gray Iron

Possesses

Valuable Engineering Properties

Part V

GRAY iron is relatively nonductile material. Its matrix is largely either pearlite or ferrite or both. These components, as they occur in other ferrous materials, cast steel, for example, possess ductility and plasticity. Steadite, the iron iron-phosphide component is brittle as shown by Bolton in THE FOUNDRY, May 15 and June 1, 1926. When present in larger amounts and under certain cooling conditions it forms an almost continuous network—other components being within this network.

Under these conditions when stressed, this continuous intercrystalline network must sustain most of the load, and many of the physical properties of the metal depend on it. When phosphorus is low the steadite network is well broken up. Furthermore higher power microscopy shows that in gray iron there are no fine intercrystalline networks of phosphides nor sulphides between the grains of pearlite or of ferrite, so the elastic phenomena must be dependent to a large degree on the properties and distribution of the three major components, pearlite, ferrite and graphite, when dealing with the low phosphorus content gray irons.

Elasticity Data

IN HIGH phosphorus gray irons, many of the physical properties depend on the continuous network of the iron-iron phosphide component. In low phosphorus irons, the elastic phenomena are dependent on the properties and distribution of pearlite, ferrite, and graphite. These and other data on elastic properties of gray iron are explained in this article which is the fifth of a series on the engineering properties of gray iron. The fourth article was presented in the May 1 issue of THE FOUNDRY.

Graphite flakes in themselves are weak and nontenacious, breaking up the continuity of the matrix. The pronounced tendency of fracture to follow along the graphite flakes was demonstrated clearly in the micrographs presented in Part II. Although the graphite flakes offer little resistance to tensile stresses, when laterally supported they offer the usual resistance of solid material to compressive forces. The percentage of graphite by volume is about three times its percentage by weight.

With that consideration in mind, some of the elastic phenomena of cast irons will be contrasted with those of steel. Young's modulus of elasticity, or the tensile modulus of elasticity (*EY*) as used in engineering practice is the relation of stress to strain within the elastic limit, that is:

$$\frac{\text{Stress in pounds per square inch}}{\text{Strain in inches per unit gage length}}$$

For pure iron and for steels (cast or worked) the modulus of elasticity generally is close to 30,000,000 pounds per square inch. While cold working increases the ultimate strength in these materials, it increases the elastic limit to an even greater degree so that on extreme cold working the elastic limit approaches and may nearly coincide with the ultimate strength, the material becoming quite brittle. In spite of the radically changed microstructure and alterations in other usual physical properties the modulus of elasticity remains constant or nearly so. Thus, the modulus of elasticity in tension appears little affected whether the material be com-

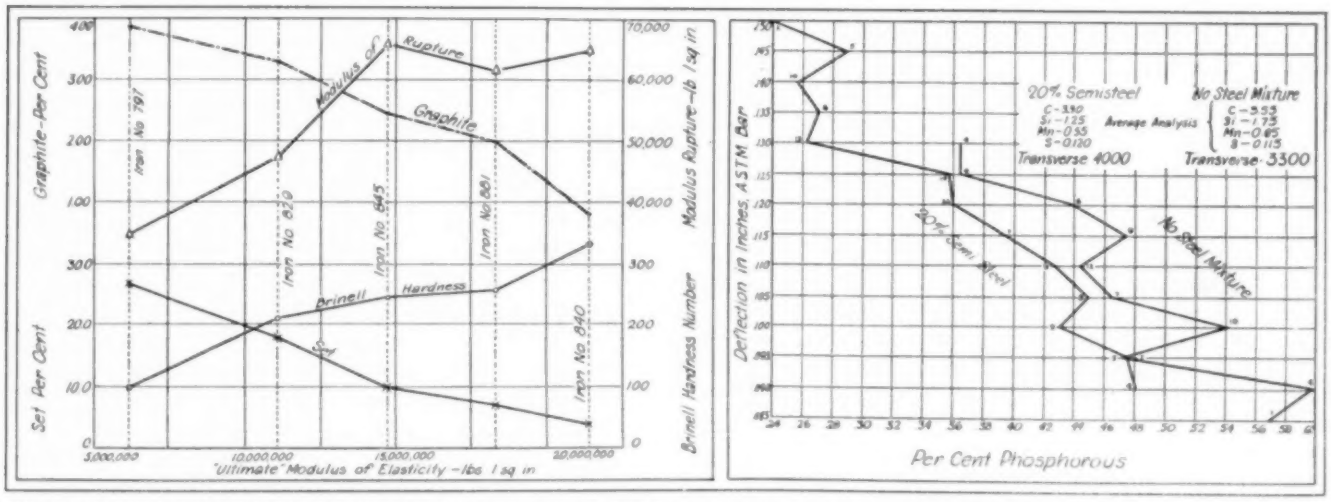


FIG. 40—VALUES FOR PLASTIC DEFORMATION (SET) IN SIX REPEATED LOADINGS TO THREE-FOURTHS ULTIMATE STRENGTH PLOTTED AGAINST ULTIMATE MODULUS OF ELASTICITY. FIG. 41—RELATION OF DEFLECTION TO PHOSPHORUS CONTENT. THE FIGURES INDICATE THE NUMBER OF SAMPLES

posed of the usual types of crystals of ferrite, pearlite-ferrite aggregate, or with the crystals severely distorted by cold work.

The stress-strain diagram for white cast iron approaches a straight line as shown by the curve for mottled iron in Fig. 42. The tensile modulus of elasticity of malleable cast iron is 25,000,000 pounds.

Contrasts Behavior

Contrasted to the elastic behavior of these ferrous materials is that of gray iron. As shown in Fig. 43 the apparent elastic moduli of various irons on primary stressing are not constant but vary with increasing load—the apparent values decreasing with increasing stresses. As a matter of strict definition since gray iron on initial stressing shows no definite elastic limit or this approaches zero, there is no definite modulus of elasticity. Yet on restressing, the apparent elastic moduli of a given iron increase. When as in the restressed bars above, apparent elastic limits are obtained and nearly constant proportionality of stress and strain exist, the elastic moduli calculated therefrom vary in the differently treated bars. For example from the data given in Fig. 28 the following values are obtained:

Bar	Young's Modulus lbs./sq. in.
Untreated	14,500,000
800 degrees Fahr.	15,000,000
1600 degrees Fahr.....	13,000,000

We may assume safely that the slight differences between the untreated iron and that normalized at 800 degrees Fahr. are due to the opportunity for some plastic readjustment in the latter, since it is well known that internal stresses in commercial castings are removed by such treatments, and there is no difference in structure in the two materials. The specimen annealed at 1600 degrees Fahr. on the other hand, has somewhat more graphite, and its matrix is practically ferrite. This has resulted in a definite lowering of the tensile modulus of elasticity. A comparable phenomenon is the change in relative moduli of irons of like analysis cast into different sized bars as shown in Fig. 44 is shown on the following page.

The effect of overstrain in steel furnishes an interesting comparison to the effect of primary strain in gray iron. If mild steel is stressed considerably beyond its elastic limit in a short time test and then restressed, the steel appears to lose its elasticity. On an immediate second application of the load, the stress-strain diagram is curved, like that of a cast iron. However if the bar is allowed to age several weeks before restressing or is heated slightly (480 degrees Fahr.) its elasticity is recovered, and usually the proportional limit in tension is increased greatly. Thus time or temperature are required for adjustment. This phenomenon in itself illustrates behavior different than that of gray iron stressed to its apparent elastic limit. Both cases involve plastic readjustment. The iron starts out with a curved diagram and approaches a *straight line with elbow* diagram. The steel starts out with a *straight line with elbow diagram* and (on immediate restressing) approaches a curved diagram. Steel is ferrite-pearlite while gray iron is ferrite-pearlite and graphite. It is to this latter component that the differences may be traceable.

At the present time researches are being conducted which may answer the questions apparent from study of the data and analogies cited. Pending detailed presentation of this material the following remarks may prove of interest and value.

The actual ductility of cast iron is low. This is due to the presence of pencil like or flake formation of free graphite carbon, and to the presence of steadite. The effects of graphite must be considered from the three dimensional concept as described by Bolton in the Oct. 1, 1929 issue of THE FOUNDRY. Those flakes which parallel the lines of stress have least weakening effect and this effect probably is directly proportional to the area the flakes occupy. However, those flakes normal to the lines of stress intensity are disadvantageous to strength, due to internal leverages set up in this brittle material. The nature of these reactions are somewhat comparable to those encountered in testing wrought iron with and across the fiber—the greater weakness and lower ductility of this material across the fiber being apparent.

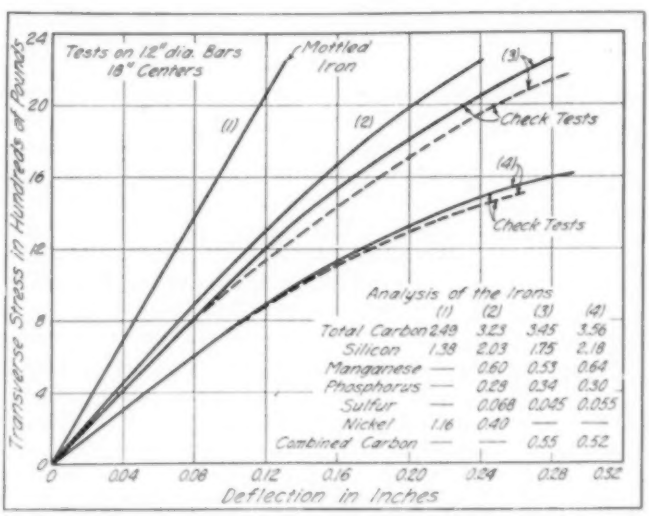


FIG. 42—STRESS-STRAIN DIAGRAMS OF DIFFERENT TYPES OF IRONS. MOTTLED IRON GIVES A STRAIGHT LINE

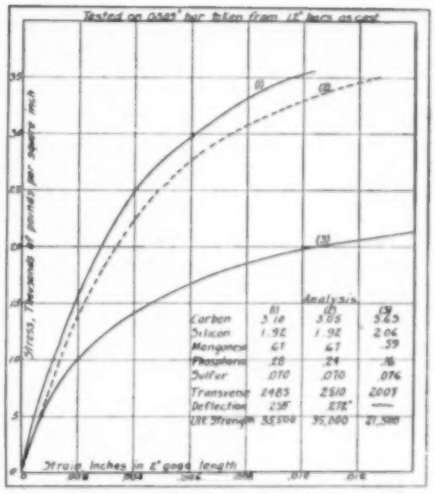


FIG. 43—DIFFERENCE IN MODULUS OF ELASTICITY IS SHOWN BY THE TENSILE STRESS-STRAIN CURVES OF VARIOUS IRON

Describes Structure

In the higher carbon commercial irons much of the graphite occurs in whorls, which Japanese workers have described pertinently as chrysanthemum-like structures. These give rise to spherical zones of weakness distributed throughout the metal. These spheres in turn are surrounded by comparatively graphite-free shells, usually pearlitic. Most of the ferrite is associated closely with the graphite in the whorl—the formation of ferrite often being along the graphite flakes. An example where the graphite-ferrite formation is surrounded completely by pearlite is shown in Fig. 45. The extremities of these shells, in high phosphorus irons, are covered by steadite formation. This gives rise to the common phosphorus network formation as seen in one plane—in a micrograph for example.

Thus in irons of this type structure the *distance between* spheres and the size through the spheres affects the strength of the material. It has been shown microscopically that fracture proceeds through the graphite flakes. As a matter of common experience the broken ends of a test bar or a

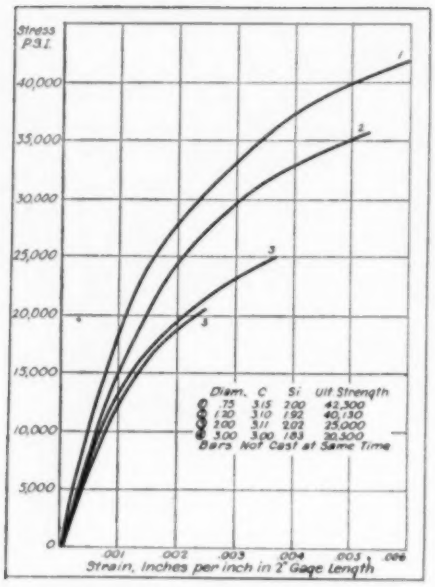


FIG. 44—TENSILE, STRESS-STRAIN CURVES OF THE SAME GRADE OF IRON WITH DIFFERENTLY SIZED BARS. ALL SPECIMENS WERE MACHINED TO 0.505-INCH IN DIAMETER FOR TESTING

piece of casting show the same thing. If such a fractured surface is observed closely, the cell-like network around the darker centers shows up distinctly. The general plane of fracture usually is nearly normal to the direction of stress. In lower carbon irons the usually more dendritic type structures give rise to cylindrical graphite groupings reaching in from the cooling surfaces. This usually means more space between graphite groupings and is a promoter of greater strength.

Stresses Are Higher

It has been shown by MacKenzie, *Proceedings*, A.S.T.M. 1925, that at intermediate loads the deflection in transverse loading at a given load usually is proportional to the sum of total carbon plus one-fourth the silicon. This is borne out in a general way by intermediate elongations in the tensile test, stress-strain curves shown. At ultimate load the ultimate tensile stretch usually is lower in the stronger irons, although for given strain the stress values are higher.

Since gray iron is a brittle and nonhomogeneous material, localized stress intensities are much higher than the average stress intensity. When plasticity is lower as indicated by higher brinell, and stress intensity higher, the lessened ultimate ductility of the stronger metal is not surprising. If by proper graphite distribution a favorable condition is provided, greater ultimate strengths with otherwise quite similar stress-strain curves may be obtained.

Although apparently having little effect at intermediate loads, increase in phosphorus decreases deflection at ultimate transverse load as shown by Bolton, *Transactions*, A.F.A. 1925; MacKenzie, *Transactions*, A.F.A. 1926; Bolton, THE FOUNDRY, May 5 and June 1, 1926 and in Fig. 41. This illustrates the effect of a particularly brittle component raising local stress intensities, and through failure, lowering ultimate ductility.

Therefore, on application of small stresses it is quite probable that the permanent deformation is due to some compacting of the graphite structures. This leads to a straightening out of the stress-strain curve after repeated applications of stress. It is not unreasonable to expect that this diagram approaches a straight line, indicating an elastic material, on sufficient number of restressings. However, if, as in a fatigue test, the direction of stress is reversed, much of this compacting effect is lost.

As the stress is increased both incipient fracture and plastic flow are possible, in addition to the compacting effect. The exact points at which these phenomena begin, of course, vary with the grade of material examined. This makes it necessary to use only those test methods which give absolute results, namely tension or compression, where the average stress intensity can be computed. The results shown in Figs. 28 and 31 and by MacKenzie in Fig. 40 indicate the sort of deformation referred to, with the probable exception of MacKenzie's iron No. 881 which contained 2.27 per cent carbon. The building up of high stress intensities with sudden releases explain the lowering of ultimate ductility in higher phosphorus irons.

Although some stronger irons show lower ultimate stretch, the greater shock resistance of these is explainable by the greater area under the stress strain diagram.

Final Volume of Survey on New England Ready

The final volume of the New England survey, entitled "Industrial Structure of New England," has just been published and includes in addition to a detailed analysis of the industries of the district, a chapter on the market for iron and steel. This chapter prepared by Edwin Bates of the domestic commerce division of the bureau of foreign and domestic commerce, in co-operation with *Iron Trade Review*, gives the total consumption of iron and steel products in the six New England states as about 1,760,000 tons per year.

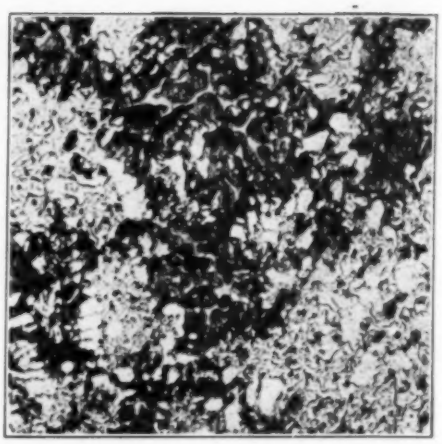


FIG. 45—GRAPHITE-FERRITE FORMATION SURROUNDED BY PEARLITE. MAGNIFIED 100 DIAMETERS PICRIC ACID ETCH

The book is known as domestic commerce series No. 28 and may be obtained by addressing the superintendent of documents, Washington. Price is $1.30.

Buys Steel Foundry of Brownhoist Company

The Ohio Steel Foundry Co. with general offices at Lima, O., and operating plants at Lima and Springfield, O., has purchased the steel foundry department and the steel casting business of the Industrial Brownhoist Corp., Cleveland. The latter organization operates a large steel foundry at its plant in Bay City, Mich., which in future will be the property of and managed by the Ohio Steel Foundry Co.

Extensive plant improvements are planned at the Bay City works which will include a modern 15-ton open-hearth furnace. John E. Galvin, Lima, O., is president of the Ohio Steel Foundry Co.

Approves Merger Plan

Stockholders of the Wheeling Mold & Foundry Co., Wheeling, W. Va., recently approved the merger plans of Coachran, Scott & Co., Chicago brokers, for the formation of the Continental Steel Foundry Co. The plans call for alliance with the Hubbard Steel Foundry Co., East Chicago, Ind., the Duquesne Steel Foundry Co., Pittsburgh, and probably several others.

John S. Walker, since 1912 manager of the Huntington, W. Va., branch of the Sullivan Machinery Co., Chicago, has retired to engage in banking business in Huntington. Morley S. Sloman, for the past 14 years associated with the Pittsburgh office of the company, will succeed Mr. Walker.

Questions & Answers on FOUNDRY PRACTICE

GENERAL

Core Shifts Bend Posts

QUESTION

We shall appreciate your opinion on why some of our lamp posts are straight while others are crooked. The casting is 10 feet in length with a metal thickness of 5/16-inch. Iron charges for the cupola are made up in the proportion of 480 pig iron to 720 machine scrap yielding an analysis in the casting of: Silicon 1.95 per cent; sulphur 0.30 per cent; phosphorus 0.18 per cent and manganese 0.51 per cent.

ANSWER

Crooked lamp post castings may be due to either one of two causes. The first and most probable is a core that is sprung in the center thus producing a casting with thick metal in the drag and thin metal in the cope side. Break one of the scrap castings and verify this for yourself. The metal in the thin side contracts first and pulls the casting crooked. Without a knowledge of the style of core and arbor employed we cannot suggest what change you should make. If you are sweeping a loam core on a light pipe, or, using a jointed dry sand core with small pipes or rods for reinforcement you will need one chaplet on the drag side in the center and two chaplets on the cope side, spaced about 3 feet apart. These chaplets must be anchored to something solid.

The second probable cause of a crooked lamp post is the manner in which the casting is shaken out. If it is stripped while red hot and allowed to lie with one side exposed while the other side still is buried in the sand, then most assuredly the stripped side will contract first and exert sufficient pressure to raise both ends any distance from ⅛-inch to ½-inch above a straight line. The safest method is to leave the castings in the molds until they have cooled. However, if they *must* be stripped early, they should be stripped clean from both cope and drag and rolled on to a pair of level skids, spaced about 5 feet apart, to cool.

THIS department covers all problems relating to metallurgical, melting and molding practice encountered in making steel, malleable-iron and gray-iron castings. Questions submitted by bonafide subscribers to this department will be answered by members of the editorial staff of The Foundry, supplemented where occasion requires by the advisory staff whose personnel is as follows:

John H. Hall—Cast Steel
H. A. Schwartz—Malleable Cast Iron
J. W. Bolton—Gray Cast Iron

All questions should be addressed to The Editor, The Foundry, Penton Building, Cleveland.

Q & A

Sand Sticks to Pattern

QUESTION

Can you suggest a preparation to be applied to the face of aluminum matchplate patterns to prevent the warm sand from sticking to them. We have tried kerosene and bayberry wax and gasoline and even have tried washing the patterns with hot water. These various treatments help, but the effect wears off after making a few molds. The molds are made on a conveyor system in which the sand attains a temperature of approximately 100 degrees Fahr. We are studying a method of reducing the temperature of the sand and that probably will cure the trouble. In the meantime we shall appreciate any suggestion that will yield temporary relief.

ANSWER

The only way to settle a problem is to settle it right, therefore you probably will have to continue using temporary relief methods until you succeed in cooling the sand to the proper temperature. In the meantime you might experiment with a gas or electric heater on a few of the patterns in which the shape lends itself particularly to the application of one of these devices. After a few trials you can adjust the heater to maintain the pattern at a temperature that will prevent the sand from sticking to it.

Q & A

Sand Mix Causes Dirt

QUESTION

I am forwarding several sections scrap radiator castings on which I shall appreciate your opinion. Facing sand is made up of old sand, 3 wheelbarrows, new sand, 2 shovels; clay, ½ shovel, and sea coal, ½ shovel. Sprues and gates are cut clean. Iron free from surface slag and hot is poured carefully through skim gates. You will note that small patches of foreign material appear here and there both on the cope and drag side in the vicinity of the gate, never more than 6 inches distant. In one of the samples you will note what appears to be a gas pocket. This always appears in the cope in the same chaplet print.

ANSWER

The defective areas are due to small floating bodies of sand and these in turn are caused either by (1) sand that is deficient in bond or (2) a sand mixture theoretically correct, but not thoroughly mixed. The appearance of the skin on the samples submitted indicates that the sand is not sufficiently refractory, that some of it fuses to the iron. From the fact that you are using clay we assume that your sand still is in somewhat of an experimental stage and we suggest you secure expert advice from the interest which supplies the clay. Clays from various sections of the country vary in their physical characteristics. Men thoroughly familiar with clay and with the sand used in any locality can make up a mixture to work satisfactorily, but amateurs usually have to do quite a bit of experimenting before they hit on the ideal combination. As a preliminary measure you might add a shovelful of sharp sand to the mixture and mill it for twice the ordinary milling time.

The blowhole around the chaplet is a more puzzling feature, particularly when you state that it always appears at this particular point on the casting. If it appeared indiscriminately we could claim immediately that it was caused by a rusty or a wet tin. A possibility exists that the stem does not come down on the center of the tin. The result is that when the pressure comes the tin tips on edge and the stem penetrates the core a short distance, just enough say, in the vicinity of a vent to induce a small puff of gas to escape at this point and form a cavity around the chaplet stem. Check up on a few molds to see if the tin fits snugly in the core depression and if the stem comes down accurately in the center. Examine the vent in the core at this point. It may be too close to the surface. The tins you are using are not tin, but thin steel plate which oxidizes easily. If they are used elsewhere they disprove another possible theory, but if you use them only in this spot they may be responsible.

Q & A

Uses Grate Bar Scrap

QUESTION

We have access to an unlimited quantity of grate bar scrap and we have been told that it is possible to run this into sashweights by using a flux. Can you give us any information on the subject?

ANSWER

As a general rule sash weight castings are made from any kind of scrap that can be melted and possesses enough fluidity to be poured into these simple castings. Consequently, the scrap grate bars would be all right for this purpose. However, considerable iron losses on a large volume of slag may be expected due to the burnt condition of the grate bars. Perhaps, it would be a good plan to begin with adding stove plate or other scrap to carry the bars, and then gradually cut down on the good scrap to a point where the sash weights just can be made. The ratio of good and poor scrap will have to be determined by experiment.

Plenty of limestone should be added to carry the iron oxides which will be present, and provision should be made to have the slag run continuously throughout the heat. Unless this arrangement is made, the cupola may bridge over. If the slag becomes too thick, which we doubt, add a little fluorspar to thin it out. Iron oxide generally forms a thin corrosive slag which attacks the lining badly.

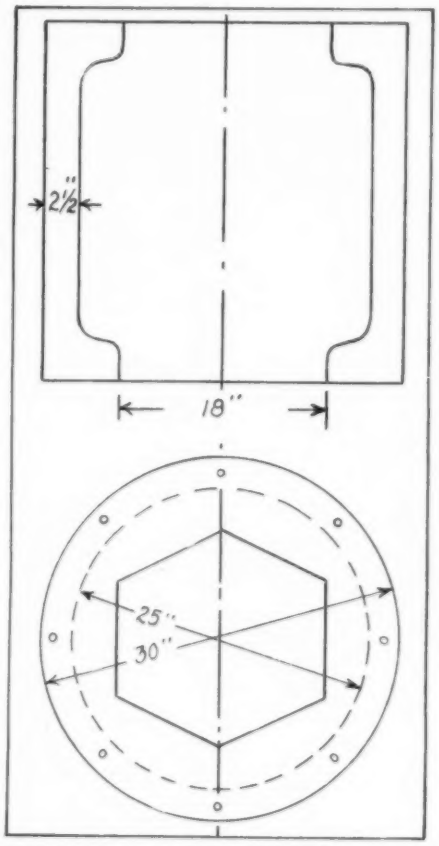
We do not know of any flux that will make good iron out of bad. Claims are made for sodium carbonate or soda-ash fluxes to remove sulphur and to degasify the metal, but we do not believe that such flux will make good iron from the burnt grate bars.

GRAY IRON

Chilled Roll Cracks

QUESTION

We are enclosing sketch of a chilled cast iron roll in which a crank appeared ¾-inch wide, extending from end to end. This casting was poured from a mixture containing 60 per cent car wheel scrap, 30 per cent pig iron and the remainder common scrap. The iron is melted in a 30-inch inside diameter cupola and since it does not come too hot the mixture was made a little harder than usual an examination of the casting disclosed an exceedingly hard core and I am inclined to the opinion that this is the cause of the trouble. Before making any more of these castings I shall appreciate your opinion.



THE ROLL IS POURED THROUGH A RING OF EIGHT SMALL POP GATES

ANSWER

The mixture you outline will show a silicon content of approximately 1.40 per cent and that will not impart a deep chill to a section 2½ inches thick. A straight car wheel charge probably will answer your purpose better. This scrap must be broken small for use in a 30-inch cupola to secure hot iron. The casting will weigh about 2000 pounds and that means two 1000 pound charges in the cupola, or preferably three 700-pound charges.

Chill cracks on the outside of a casting may be due to one of several causes but in this particular instance you probably are right in your opinion that they are caused by a hard core. The metal against the chill solidifies first and unless this shell can force the remainder of the metal inward, it will crack later when the inner metal contracts. The remedy is to provide a core that will yield more readily than an ordinary core. A green sand core rammed on the drag would be the ideal solution, but if your corebox is not adapted to this method, a suitable dry sand core can be made up as a shell 2 or 3 inches thick. This core will contain a minimum amount of binder and the inside can be filled with dry, old molding sand after it is placed in the mold. This inner sand is not rammed, but simply is shoveled in loose. Its main purpose is to prevent iron from leaking into the opening. The best way to pour the casting is through a ring of eight or ten ¾-inch diameter pop gates. These gates will introduce the metal rapidly and distribute it uniformly all around the mold. Also, with this method of gating, the hottest metal will be on top of the rising column and will prevent waves and wrinkles on the face of the casting. See that the gates are perfectly perpendicular so that the metal does not strike the core or the face of the chill.

Q & A

Hardens Plow Shares

QUESTION

Can you tell us whether it is better to harden cast iron plow shares by dipping in a vitriol-cyanide solution or to cast the metal in chills, or is it better to combine the methods? What are the principle uses of semisteel? Could 50 per cent steel and 50 per cent iron be used for making toggles for sugar cane mills? These toggles are supposed to break before the rolls when the mills get choked.

ANSWER

Whereas methods are published for obtaining a hardening of the surface of cast iron by immersion in cyanide, we do not believe that it will be satisfactory. In plow points a deep chill must be obtained so that point will wear away slowly. If only a surface chill is obtained, the point will wear away rapidly as soon as the slightly chilled section is removed. Therefore, we suggest that you follow the method employed by plow point makers in this country. This is to use iron chills on the points, and use a mixture that will chill. Such a mixture

may contain about 1.20 per cent silicon depending upon the amount of chill desired.

In your reference to toggles we assume that you mean cast iron coupling boxes which fit on the ends of the wobblers on the rolls. Whether a 50 per cent steel mix would be satisfactory depends on the kind of pig iron used with it, and cupola practice. The best method to determine the mixture to be used is to obtain a coupling box that works satisfactorily at present. Break it open and examine the fracture. Have an analysis made, and then develop a mixture that will give the same composition and possess the same fracture. The correct way to make a casting of this type would be to determine the stress that the roll wobbler would withstand without breaking, and then make the coupling box of the proper section and mixture so that it would break just below this point.

Q & A

Permanent Mold Data

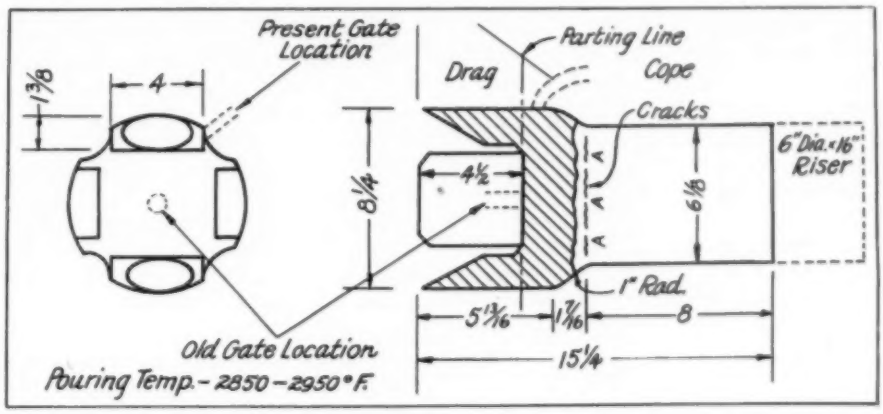
QUESTION

Can you supply us any information on the following questions on permanent molds? What kind of iron is used; how thick should the molds be in relation to the thickness of the castings; what are the molds coated with to prevent the iron sticking? Are the molds machined where the edges come together; how many castings can be made from one mold; how are the gates made, etc.?

ANSWER

Complete data on your questions only will be supplied by careful experimental and research work on your part. Considerable material on these points has been obtained by some firms who are making permanent mold castings or selling permanent mold machines, but they undoubtedly have their methods protected. The type of iron used for the molds will have to be one that will withstand heat, be fine grained, and be machinable. One formula suggested for this purpose contains 2.0 to 2.25 per cent silicon; sulphur, low as possible; phosphorus, not over 0.20 per cent, and manganese, 0.70 to 0.90. Another mixture suggested has practically the same analysis but uses 15 to 30 per cent pig iron containing nickel and chromium in the charge. A third mixture contains 1.45 per cent silicon, 3.0 per cent nickel and 0.90 per cent chromium.

A method for computing the thickness of the mold is given in an article, "Brass Is Cast Successfully in Permanent Molds," by Henri Marius which appeared in the Aug. 15, 1929 issue of THE FOUNDRY. While this formula was used for brass bushings, the author states that it will apply equally well for other materials. This article also describes the way in which the mold is constructed and its life. However, in the case of iron, mold life may be expected to be shorter than that given. In most instances the adjoining edges of the mold must be machined to obtain a good fit. Material used to prevent the iron sticking varies. Try a clay wash using sodium silicate instead of water. It must be thin enough to dry shortly after being applied to the mold face. Smoking the mold face also is done. However, the thin clay face also is necessary. Smoking may be accomplished with acetylene gas, natural or city gas adjusting the burner so that a smoky yellow flame is present.



CRACKS IN THE ALLOY STEEL CASTING SKETCHED ABOVE MAY BE REMEDIED BY SLOW COOLING IN THE ANNEALING FURNACE

STEEL

Steel Castings Crack

QUESTION

We are enclosing a sketch of a chrome-nickel steel casting which we have been making and which has given us a great deal of trouble. We have done everything we know in attempting to eliminate the cracks which are in the position shown in the sketch. They are not visible until a slight cut is taken in machining. The cracks appear to be heat cracks or slight draws. They are ¼ to ¾-inch deep, ¾ to 2 inches long and the thickness of a hair. The castings are made in green sand which is skin dried over a charcoal fire. They are poured from steel made by the acid process in an electric furnace. The pouring temperature is given on the sketch, and the analysis is as follows: Carbon, 0.35 to 0.45 per cent; manganese, 0.60 to 0.80 per cent; chromium, 0.90 to 1.25 per cent; nickel, 1.50 to 2.00 per cent; silicon, 0.25 to 0.40 per cent, and phosphorus and sulphur, 0.04 per cent maximum.

ANSWER

From the information given it is difficult to say why the casting described should crack, unless it is because of the stresses set up at the point where the section of the casting changes as the piece cools off in the mold. Nickel-chrome steel containing 0.40 per cent carbon is quite *tender* and frequently will crack or tear where a similar casting of ordinary steel would be free from defects.

In the absence of more details as to what has been tried to prevent these cracks, we suggest that the castings be shaken out of the molds when still at a bright red heat, and transferred to an annealing furnace which is at about the same temperature of the castings. When all the castings are charged into the furnace, they can be allowed to cool slowly. Then they can be cleaned and chipped, and the risers removed, after which the castings should be annealed taking care to heat them slowly until they have reached a red heat. The annealing practice followed from that point should be governed by the critical points of the metal.

MALLEABLE

Use Litharge Mixture

QUESTION

We are engaged in the production of malleable iron castings and would like to obtain some information on the best material for use in making hard matches for gated pattern equipment and vibrator frames.

ANSWER

Some foundries use a litharge mixture for making hard sand matches of the type you have in mind. One mixture calls for 15 pounds of fine molding sand, 1 quart of boiled linseed oil and 4 ounces of litharge. Mix the litharge and sand together before adding the linseed oil. Make up the match in the ordinary way. Secure all the frail edges carefully and then bake thoroughly in a core oven. After it is dry it may be shellacked. Hard matches of this type seem to work well, provided the service demanded is not to severe.

Problems in Nonferrous Founding

By Charles Vickers

Phosphorus Is High

We have been asked by one of our customers to make some bearings 2½ inches thick and having an analysis of 82 per cent copper; 8½ per cent tin; 8½ per cent lead, and 1 per cent phosphorus. The physical qualities of the metal must be such as to withstand a severe and intermittent hammer shock without either breaking or hammering out. We made four sample bearings to the above specifications and had quite a lot of trouble in getting four good ones. After machining, the castings showed a coarse open structure, also the cope side of the casting was spongy with patches of small gas holes. This alloy is quite liquid when molten due to the high percentage of phosphorus, and we tried pouring it from about 1400 to 1800 degrees Fahr. We finally arrived at a pouring temperature of 1680 degrees Fahr., and were able to make 4 good castings. We also added 0.25 per cent nickel, hoping it would help the physical properties, but when the castings were put into service they both hammered out and broke.

The thing that is wrong with the alloy given is the 1 per cent phosphorus content, and it is that which causes trouble for the founder. When the phosphorus is reduced to 0.25 to 0.5 per cent of phosphor-copper containing 15 per cent phosphorus, not the least trouble is experienced in making castings of the alloy. As regards compressive strength, a good way to figure is that 2 per cent tin equals 1 per cent phosphorus. If, instead of the previously mentioned alloy the customer had asked for 79.50 per cent copper; 10.50 per cent tin, and 10 per cent lead, with no phosphorus, he would have gotten a better alloy as it would contain no lines of intercrystalline brittleness due to phosphide inclusions. When making such an alloy, no founder would omit phosphorus as a deoxidizer, but the amount so added would not be more than to confer liquidity on the molten metal. Although the presence of phosphorus could be recognized; it would not be enough to cut through the sand of the mold like water. Such an alloy will withstand severe and intermittent hammer shock. Whether it would hammer out or not would depend on the severity of the service to which it was subjected, which might be such as to require a little higher tin.

The pouring temperature of heavy mill bearings with metal of low phosphorus has to be high, or what some founders might think was high, for instance, 2000 to 2100 degrees Fahr., and heavy stick brass is poured up to 2200 degrees. If this is not carried out, time-consuming precautions must be taken to control shrinkage, which limit production and increase cleaning costs.

Alloys that are highly phosphorized must be poured cooler in green sand molds, but can be poured at a much higher temperature in baked, and plumbago washed molds. The addition of from 0.7 to 1 per cent phosphorus to leaded bearing alloys produces much phosphide which has a great tendency to gravitate towards the outer skin of the castings, displacing lead and causing machining difficulties. Also if blowholes are present the phosphide will be found segregated at those points. In the case of non-leaded alloys, the effect of high phosphorus is quite different, but in the case of the leaded bearing metals it is best to use tin as the hardener, and phosphorus as the deoxidizer.

Q & A

Make Aluminum Bronze

Will you please furnish us with information on mixing and melting aluminum bronze?

There are a number of alloys known as aluminum bronze. What is known as the straight aluminum bronze contains 90 per cent copper, and 10 per cent of aluminum. However, a better alloy results when the copper and the aluminum are mixed in the proportions of 89½ per cent copper and 10½ per cent aluminum, and these proportions should be weighed exactly using 89½ pounds of copper to 10 pounds, 10 ounces of aluminum. This is an increase of 2 ounces of aluminum to allow for loss of the latter by oxidation.

Another alloy that finds extensive use for castings is 89 per cent copper 10 per cent aluminum, and 1 per cent iron. In other alloys, the iron may be increased at the expense of the copper, thus one government specification required 86 per cent copper; 4 per cent iron, and 10 per cent aluminum. The ductility of the copper-iron-aluminum series of alloys is increased by increasing the percentage of copper at the expense of the aluminum. An alloy of 89 per cent copper; 3.50 per cent iron, and 7.50 per cent aluminum, is both strong and ductile. It is as strong as any ordinary manganese bronze, with a much higher elongation than manganese bronze. This alloy will have a tensile strength around 75,000 pounds per square inch; an elongation in 2 inches of 38 per cent; 32 per cent reduction in area and a brinell hardness around 80.

Aluminum bronzes are made by first melting the copper. A crucible is the best way of making the alloys, the copper being melted under charcoal. The iron should be added next in the shape of loosely rolled tin plate, which is immediately stirred into the copper; then the aluminum follows. It is important to use the best grades of electrolytic copper only. Ingot casting copper is not suitable for this purpose as it may contain impurities that ruin the properties of the bronze, bringing its strength down until it is no better than the common alloys. The difficulties encountered in making castings of this bronze are such that it would be wasteful to use it in cases where a common casting alloy would work just as well, therefore for this reason alone it is inadvisable to be careless in the matter of the quality of the metals that are used.

The molds should be so made that liquid metal flows in without agitation. It must enter quietly with no splashing or dropping anywhere. Agitation causes it to lather in a manner similar to soapy water. The lather is dross and it will come to some surfact of the casting, and ruin it.

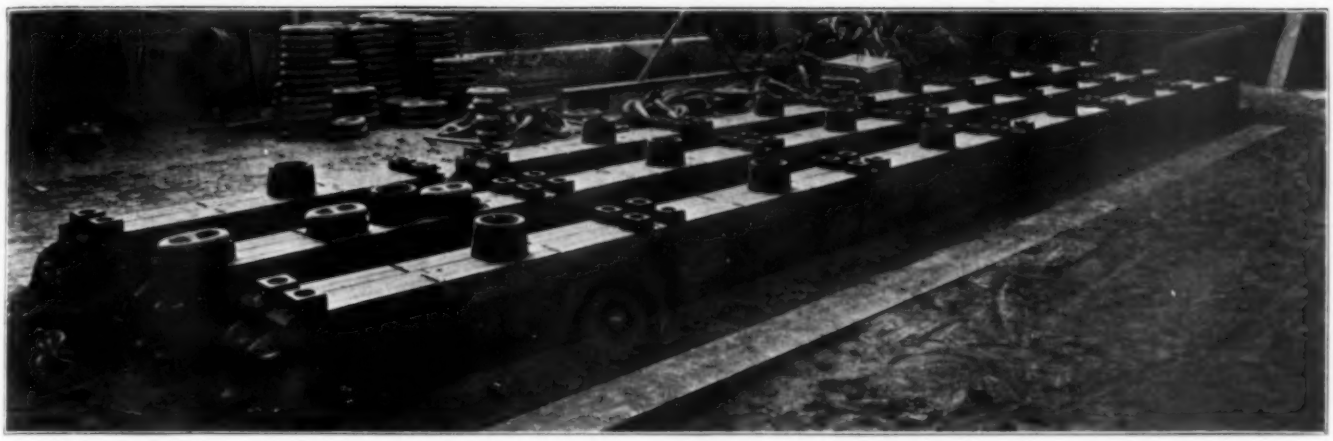


Fig. 1—The oil sand cores or molds are assembled on long steel channels imbedded in the floor. The channels give a firm level surface which is necessary to the process

Oil Sand Cores Used
in Casting Alloy Steel Chains

By J. C. Pendleton

MANUFACTURE of cast steel chain as practiced at the Norfolk Navy Yard to meet the navy specifications necessitates knowledge of metallurgy, the art of pattern making and molding to a high degree. In 1924 when that navy yard began to manufacture cast steel chain, the methods used were unsatisfactory from the viewpoint of efficiency, but continued changes in alloys, molds, and sands have developed a practice and product that are a matter of pride to the Norfolk Navy Yard.

Navy specifications for cast steel chain are rigid as may be seen by the following physical requirements: Tensile strength, 100,000 pounds per square inch minimum; yield point, 60 per cent of the ultimate tensile strength minimum; reduction in area, 18 per cent minimum, and elongation in 2 inches, 10 per cent minimum. The chemical composition is left to the discretion of the contractor. To show the difficulties involved in producing a cast steel chain, one of the 1-inch wire diameter chains will be taken as an example.

The chain is cast in dried, oil-sand molds and consists of two operations. These are the precasting of single links and the casting of connecting links by placing precast links in specially designed molds. This method allows production of chains of any length or endless chains. Needless to say, the patterns must be accurate and true, taking into account shrinkage, etc. Since the molds are dried, oil-sand, the pattern work is in the form of core boxes as follow:

An all metal core box for the drag half of the precast links.

An all metal core box for the cope half of the precast links.

An all metal core box for the connecting links.

A wooden core box for the runner and riser core.

A wooden core box for the connecting link gate core.

A wooden core box for riser core.

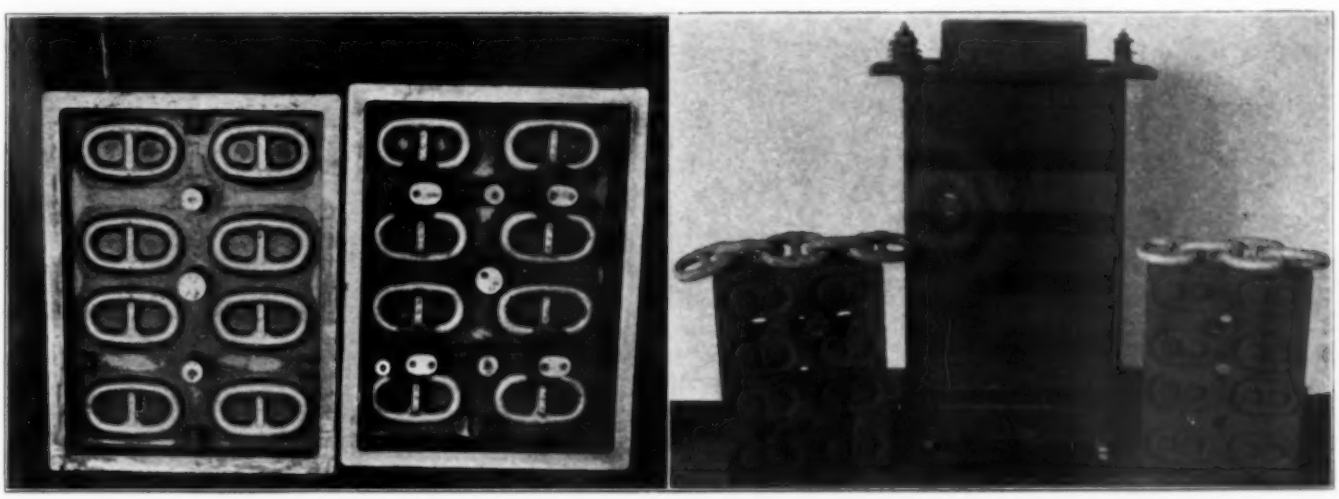


FIG. 2—VIEWS OF THE DRAG AND COPE CORE BOXES FOR MAKING MOLDS FOR THE PRECAST LINKS. FIG. 3—COPE AND DRAG MOLDS AT THE LEFT AND RIGHT RESPECTIVELY WITH THE METHOD OF STACKING IN THE CENTER

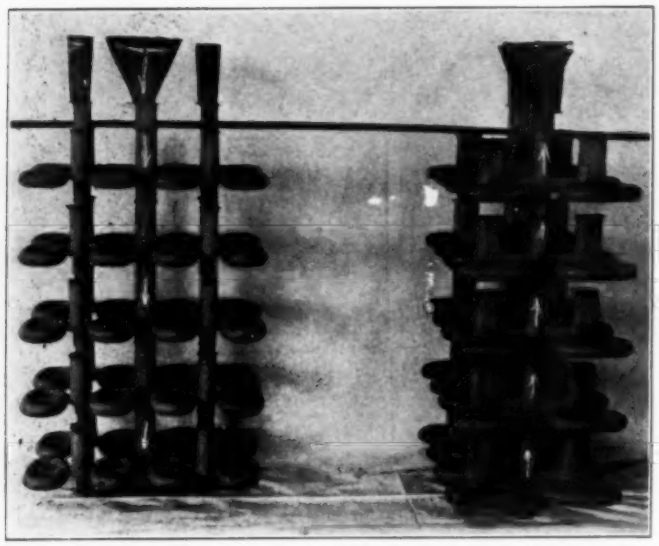


FIG. 4—TWO VIEWS OF THE PRECAST LINKS OBTAINED FROM STACKED MOLDS TO SHOW THE COURSE OF THE MOLTEN METAL

A wooden core box for the precast link gate core.

Sand used in the molds is composed of linseed oil-base core compound and sharp lake sand.

To enable a better visualization of the methods employed reference will be made to the accompanying illustrations which clearly show the essential features involved. Fig. 2 shows the core boxes required for the molds for the precast links. These are mounted on a roll-over core machine when in operation. Fig. 3 shows the method of stacking the molds and a cope on the left and a drag on the right.

The stacking arrangement follows: A cast-iron plate with a slot and lug is placed on a board. The bottom gate core, which contains channels to conduct the metal from the central sprue to the risers which lead to the links, is placed on the plate. The gate core is followed by a drag core and then by a cope core. This method of placement is followed until the stack contains five molds. A cast-iron plate similar to that on the bottom is put on the top and the two plates bolted tightly together. The runner and riser cup are placed in position and the stack is ready to be poured. As may be seen in Fig. 2, each mold contains eight precast links or 40 to the stack. The course of the molten metal clearly is depicted in Fig. 4 which contains two views of a stack of precast links before the sprue and risers are removed. The view at the left shows the downward course of the metal in the sprue and the view at the right, the upward flow in the riser. As the metal flows up through the riser it feeds into the branch gates and thence into the castings and blind risers or shrink balls as they sometimes are called. After the precast links are obtained, the next step is to connect them together and form a continuous chain 90 feet long. The connecting link mold patterns or core boxes are shown in Figs. 6 and 9. This is made of cast iron and bronze with the sides indicated by *A* in the illustrations arranged so that they will strip and leave the impressions in which the precast links are placed. The mechanism that moves the sides of the boxes is controlled by the handle designated as B in Fig. 6. One revolution of the handle provides sufficient movement to allow removal of the cores or metal parts from the boxes. The two boxes shown produce one compete mold which is assembled from the four cores lying on plate *C* in front of the machine in Fig. 9. The risers are shown at *D* and the gate is attached to the riser. The connecting link cores are made from the same sand mixture as the precast link cores with the exception that a larger amount of binder is used to make them more rigid. The dimensions of the cope cores are 2¼ x 4 x 22 inches and the drag cores, 2¼ x 2½ x 22 inches. Each mold when assembled, represents three connecting links as will be shown later.

Fig. 5 shows the method of assembling the connecting link cores with some of the precast links in place. This is arranged specially to show the various steps. In actual practice the molds are erected on channel irons, 10 inches wide as shown in Fig. 1 which provide a true surface of the proper length and width. In laying down the cores, the gate

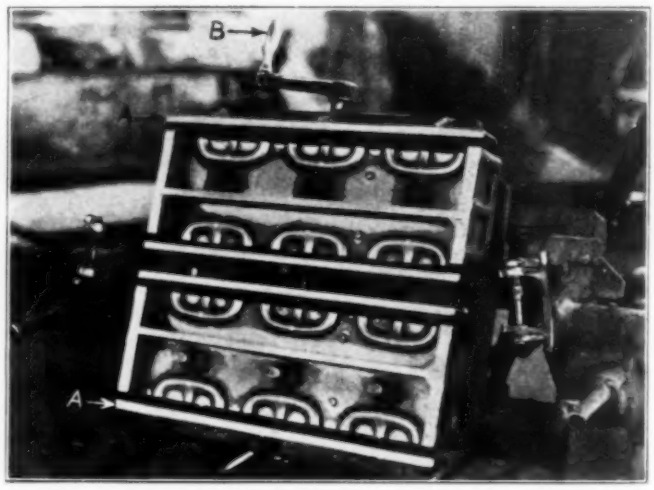


FIG. 6—THE CORE BOX FOR MAKING THE MOLDS FOR THE CONNECTING LINKS IS ARRANGED SO THAT THE SIDES STRIP AWAY

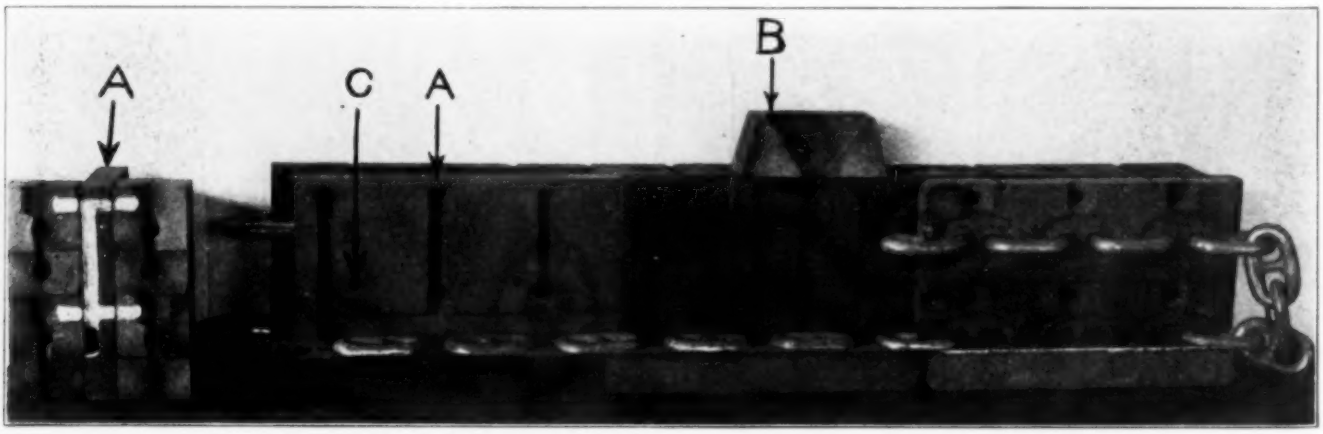


FIG. 5—SECTIONS OF THE MOLD SPECIALLY ARRANGED TO SHOW THE METHOD OF ASSEMBLY. THE CENTRAL CORE IS THE RUNNER CORE WHICH SUPPLIES MOLTEN METAL TO THE MOLD CAVITIES

core designated *A* in Fig. 5 is placed in the center of the channel iron. The drag sections of the first layer of cores are set against the gate core on either side. The precast links are put into the recesses left for that purpose. The cope cores of the first section which contain the risers that connect to the gate then are placed on the drag cores and complete the first row of molds. The next row similarly is placed as shown in the illustration. The molds then are bolted together with ⅝-inch bolts and 10 x 10 inch plates as shown in Fig. 1. The bolts pass through the holes marked *C* in Fig. 5, and no clamping or weighting is necessary.

The course of the molten steel is depicted in Fig. 8 in which two rows of chain have been removed to show it more clearly. One section of chain removed is lying in front to show the narrow sections of metal connecting the castings with the risers.

FIG. 7—FIVE SHOTS OR LENGTHS OF CHAIN. AS MAY BE OBSERVED THESE CHAINS ARE CAST ENDLESS

The runner cup which feeds molten metal to the runner is shown at *B* in Fig. 5. The metal flows up from the runner into the risers and thence into the mold cavities. This system has several advantages. It provides a bottom pour which gives cleaner metal and introduces the metal by only one riser which eliminates the expense of chipping off a gate from the casting. As each set of molds for a length of chain or shot, as it technically is known, is assembled, a chart is made so that the various links used in the chain may be traced back to their original heats if they give trouble. The links are marked with numbers for tracing purposes, but the chart makes the process doubly sure, and is necessary if the numbers on the links become obliterated. Fig. 7 shows chains a fraction over 90 feet long cast endless so that any one defective link may be removed. If more than one link is defective, they are removed from the chain which is returned to the foundry for the casting of replacement links. A chain of that length will contain 273 links. During the manufacture of the shots of chain shown in Fig. 7, at least two tensile test specimens were supplied from each heat of metal for the links. The specimens were prepared and tested to meet the contract specifications. In addition to the test specimens, a link in each of two test chains was cast from each heat of metal. The links of the test chain which are tested to destruction in a tensile testing machine, are of the same size and diameter as the regular chain.

FIG. 9—FOUR CORES TURNED OUT FROM THE CONNECTING LINK CORE BOX ARE USED TO FORM A COMPLETE MOLD

The test chains must be heat treated at the same time and in the same furnace as are the chain shots which they represent. The tensile test specimens first are subjected to the required tests specified in the contract. After they have passed the tests satisfactorily one of the test chains is pulled on a standard testing machine until it ruptures. The minimum breaking stress for the type of chain described is 84,000 pounds per square inch. If the first test chain falls below this minimum value, the second chain then is tested. If the second chain fails to meet the requirement, then the links in the complete shots which the test chain represented, are rejected and new links are recast. The rejected links are those from the same heat as the links that failed in the test chain.

In the event of recasting the links, a new test chain is made up and

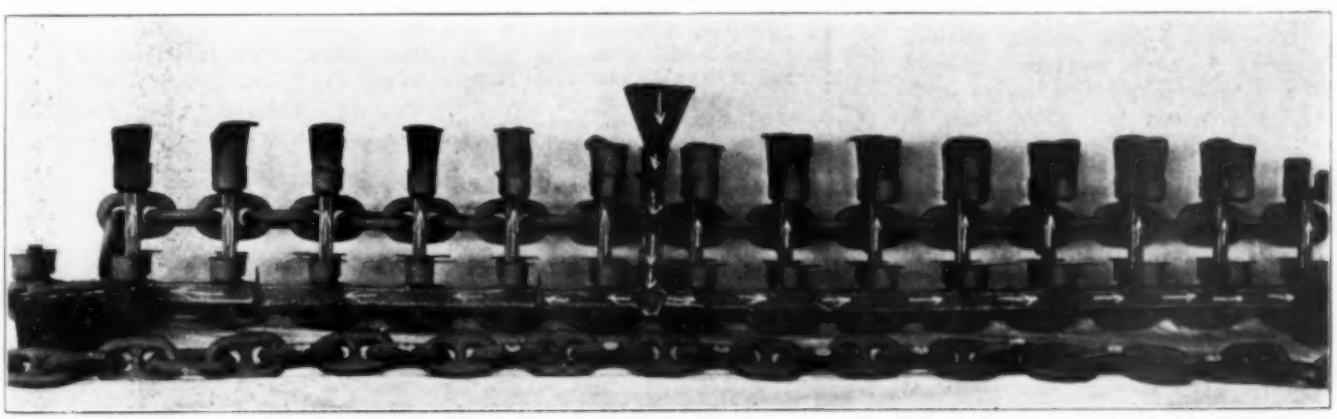


FIG. 8—PART OF A CHAIN CASTING WITH THE CHAINS REMOVED ON THE FRONT TO SHOW THE COURSE OF THE MOLTEN METAL. THE BLIND RISERS TO WHICH THE CHAIN WAS ATTACHED STILL ARE IN POSITION, AND ONE SECTION OF CHAIN IS SHOWN BELOW

subjected to the previously mentioned test.

When the tensile test specimens and the test chains representing the heats entering into the various links in the complete lengths of chain have met the tests successfully, the complete shots are subjected to a proof test which consists in anchoring one end of each shot in a chain testing machine and subjecting it to a tensile proof load of 60,000 pounds per square inch. After the proof test, links should not show any surface rupture or deformation.

If any of the links of a shot should fail during the test, new links may be cast in and the shots heat treated and subjected to the required proof test. If the shot then passes the proof test, the shot is accepted, provided that the new links are poured from a heat represented in a test chain which has passed the prescribed tests and provided that the shot complies with the specifications. If the shot does not withstand the retest, the links of the shot which were poured from the same heat as the links which failed on the first and second tests will be rejected.

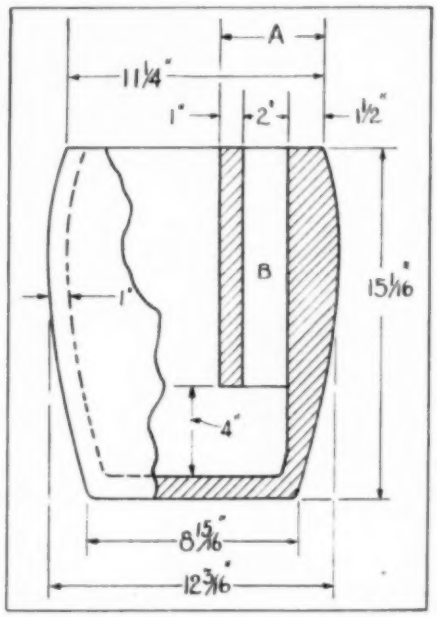
After the proof load has been released, and while the length of chain still is subjected to a tensile load not in excess of 6 per cent of the specified proof load, the overall length of six consecutive links, measured from every third link is checked for compliance with dimensions and tolerances. After completing the proof test the chain is laid out and each link surface inspected and measured for outside length, outside width, and wire diameter. Dimensions must conform with the nominal dimensions within the permissible tolerances allowed.

When the chains have passed the proof test and the dimension requirements satisfactorily, they are weighed. The weight of the lengths or shots of chain ordered must not be more than 2½ per cent under, nor 5 per cent above the weight specified for the particular class of chain which in this case is 855 pounds. Before shipment the chain must be immersed in a bath of asphaltum mixed with turpentine substitute. The bath is maintained at a temperature as near to the boiling point of the mixture as is practicable.

The asphaltum bath is mixed in ratio of 100 pounds of asphaltum to 25 gallons of turpentine substitute. If the results of the physical tests for any heat do not conform to the specified requirements, the manufacturer may reheat-treat such heat, but not more than two additional times. After the reheat treatment, tests are made as specified for a new heat.

Uses Special Crucible

The brass foundry of Bishop & Babcock Co., Cleveland, employs a graphite crucible, resembling the tea-pot type used in gray iron foundries, for pouring nickel-silver castings. A cross section of the crucible is shown in the accompanying drawing. The crucible is provided with a built-up wall at one section, as at *A* in the sketch, through which a hole, *B* about 2 inches in diameter, extends from the top to within about 4 inches of the bottom where the built-up wall



CRUCIBLE FOR POURING NICKEL-SILVER ALLOYS

ends. The pots are No. 70 crucibles with 210-pound capacity and, as has been previously stated, are used to pour nickel-silver alloys. Some exceptionally fine castings have been produced by the use of this type crucible since, it is claimed, it prevents the slag from being poured off with the metal even in small amounts. Complete absence of slag is a condition which is paramount for the production of this class of work.

Book Review

The Principles of Iron Founding; by Richard Moldenke; cloth, 654 pages, 6 x 9 inches; published by the McGraw-Hill Book Co. Inc., and supplied by THE FOUNDRY, Cleveland, for $6 plus 15 cents postage, and in London by the Penton Publishing Co. Ltd., 416-17 Caxton House, Westminster, for 30s 6d.

This is a second edition of a well known work first issued in 1917 and intended primarily for the practical gray iron foundryman who desires to keep posted on the development of foundry metallurgy and for the foundry metallurgist who has little time for original research. The object of the book is the elucidation of the principles underlying all the processes involved in the art of iron founding. Advent of high test cast iron has induced the author to revise the first edition to a considerable extent. The general arrangement of the chapters has been maintained but extensions and explanatory memoranda have been incorporated to a considerable extent in this second edition.

Through his prolific contributions to foundry literature, membership in various associations, lecture tours and consulting practice, Dr. Moldenke enjoys an international reputation in the foundry field. His observations and experience of a lifetime spent in his chosen field are compiled in this present volume. The scope of the work is indicated under the following 13 chapter headings: Historical, industrial status of the foundry, foundry organization, outline of iron metallurgy, outline of iron making processes, properties of cast iron, classification of castings, foundry raw materials, the technology of combustion, melting processes, melting processes continued, mixture making, testing cast iron.

A glossary of foundry terms is included, also an appendix containing standard specifications for purchasing, sampling, testing and methods of analysis of foundry materials and products. An exceedingly complete cross index of 28 pages supplies ready reference to the text. The book is highly recommended to all progressive foundrymen. Additional up to date material to the extent of 137 pages will commend the volume to those already in possession of a copy of the first edition.

Duquesne Steel Foundry May Join Group

Stockholders of the Duquesne Steel Foundry Co., Pittsburgh, are considering an offer made by a Chicago group seeking a consolidation of that company; the Wheeling Mold & Foundry Co., Wheeling, W. Va.; the Hubbard Steel Foundry Co., East Chicago, Ind., and possibly other steel foundry concerns. The Continental Steel Foundry Co. is also mentioned.

A total of 4,194,975 short tons of molding sand valued at $4,458,508 was mined in the United States during 1928, according to the department of commerce. That represents an increase of 586,781 short tons in production and $631,461 in value. Ohio was the largest producer with New Jersey, Michigan, Illinois, New York, Pennsylvania and Indiana following in the order named.

Fundamentals of
FOUNDRY PRACTICE

Many Types of Chaplets Are Available for Foundry Use—Experience Dictates the Most Suitable Types

By Ivan Lamoureux

Interpreted in the Light of American Practice by Pat Dwyer

Part XI

IN MANY foundries, particularly where large castings are made, it is customary to clamp the copes to fixed anchorages in the floor instead of loading them with heavy weights. The cope is bolted by rods bedded in the ground and connected together at their lower ends by heavy cross-beams. The ends of these rods, usually made of cast iron, have a *T*-slot at their upper ends which permits entrance of a bolt head.

Good Results Obtained

The *T*-slotted heads of these rods generally come up close to the ground level. The heads of the bolts are placed in the slots. The upper rails or binders are set in place and the flask is clamped down solidly. The arrangement is illustrated in Fig. 124.

If the rods and bottom cross-beam are well bedded into the ground, this method of clamping the flasks gives good results. It is of real service, where duplicate castings are required frequently and particularly when casting tubular pieces horizontally where the pressure is enormous.

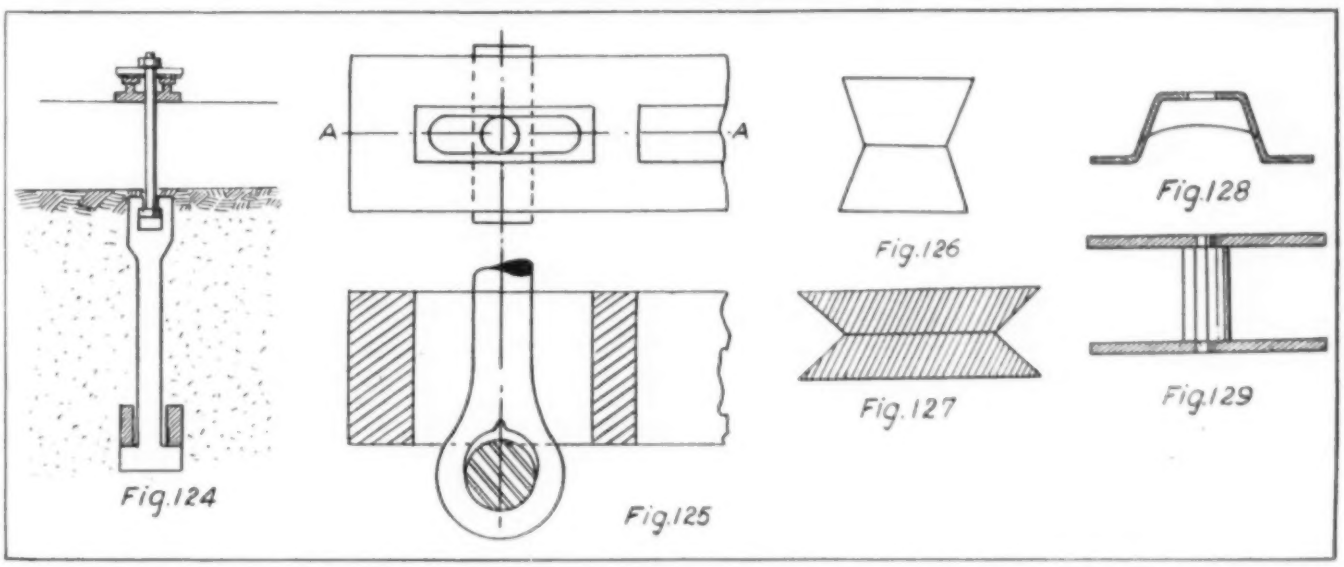
In small foundries, the use of pits and fixed anchorages has the advantage of reducing the investment in expensive weights and the space necessary to store them. Disadvantage lies in the reduction of available surface for floor molding, due to the fact that the rods and cross-beam are sunk into the ground of the foundry floor to stay.

Types of Chaplets

IN FOUNDRIES where large castings are molded in the floor, fixed anchorages are provided for holding the copes firmly in place while the metal in the mold is in a molten condition. In the majority of cases this method of holding the cope in place is preferable to the alternative method of loading it with iron weights. Wherever possible a casting should be designed in a manner that will permit the core to be held in place without the aid of chaplets. However, in many instances the use of chaplets is unavoidable. Where they are employed with proper care and discretion they serve a useful purpose and do not detract from any of the physical qualifications of the casting. A great variety of styles is available from which a type may be selected to fit any particular requirement.

Pits Are Provided

In large foundries where many of the castings are molded in the floor, the usual practice is to provide several pits, square, rectangular or circular, depending on the shape of the castings to be molded in them. In some instances heavy iron plates are bedded in the bottom and these plates are perforated for the insertion of hook bolts at various points. Hook bolts also engage the plates on the outer edge. Under certain conditions and where the strain is not too severe, this type of pit equipment renders excellent service and produces fine castings.



FIGS. 124 AND 125—BINDING EQUIPMENT FOR MOLDS MADE IN THE FLOOR. FIGS. 126 AND 127—SOLID SPOOL CHAPLETS FOR HEAVY SECTIONS. FIG. 128—LIGHT SHEET METAL CHAPLET STAMPED TO SHAPE. FIG. 129—PROBABLY THE MOST COMMON OF ALL CHAPLETS, MADE UP OF TWO CIRCULAR OR SQUARE HEADS RIVETED TO A STEM

In other instances the foundryman prefers to lay heavy cast iron or steel binders on the bottom of the pit. Plates are laid on these binders and the anchor bolts are attached to the ends of the binders in any one of several alternative methods. In one, the end of the bolt is formed like a stirrup to embrace the end of the binder. In a second, the end of the bolt is equipped with a toe or with a nut, which engages the binder at the slotted end. In a third method the lower end of the bolt is formed in an eye. The eye is dropped through a slot in the horizontal binder and a short section of steel shafting is slipped through it at right angles to the line of the binder.

Pits designed for the molding of extremely large castings are built of reinforced concrete with anchor bolts or loops firmly embedded in the walls and therefore absolutely rigid. The top of each loop is flush with the top of the pit wall and a recess is provided all around it for the reception of the lower end of the clamp or hook employed to secure the cope. Many pits of this type are adjustable to the extent that they may be divided into several sections if necessary by suitable bulkheads. In some foundries the walls of the pits are formed of steel sheets or cast iron plates instead of concrete. The first requirement of a pit is that the wall shall be strong enough to resist all lateral pressure. The second is that it shall be waterproof. A leaky or damp pit is a constant source of expense, trouble and danger.

Chaplets are small, metallic distance pieces used in connection with cores. They have a thickness equal to the thickness of the casting walls in which they are placed, and as they are imbedded in the iron they should be able to stand the contact of the latter without causing any dangerous reactions. For that reason they are usually cleaned and tinned.

Some manufacturers make a variety of the most diversified shapes of chaplets to which they attribute the advantage of fusing with the cast iron so as to prevent the slightest leak when placed under pressure. The iron would have to be raised to a high temperature for proper fusion to occur by simple contact between the chaplet and the molten iron. Under the influence of this temperature the chaplet may become soft. A chaplet is made for the express purpose of resisting stresses which sometimes are considerable. If it is supporting this strain near the point of fusion, then the security is doubtful.

On general principles, the heavier and thicker the casting, the more solid should be the chaplet. If placed near the gates, the chaplets should be stronger than if placed elsewhere. For this reason, particularly in rough parts, the use of large cast iron chaplets is advisable. On machined parts, strong chaplets of riveted construction are used satisfactorily.

Stamped or cut out chaplets are used freely in small castings with heavy sections at the point where the flow of iron is almost nil. For castings up to ½-inch thick, chaplets made of sheet metal 1/25-inch thick should be used, whereas for castings 2 inches thick, sheet metal ⅛-inch in thickness should be used. If the sheet metal is too thick in relation to that of the casting, deep blow-holes will be produced in the casting and the metal will be chilled at that point.

In thick castings where the spots do not require any dressing, cast iron chaplets having the form of a spool can be used advantageously. The reduction in cross-section midway on the chaplet insures a solid seat for the chaplet in the casting.

Sometimes, cast iron bars are made with a cross-section shown in Fig. 127 in which the length varies between 12 and 20 inches. These bars are then broken up into the various lengths required by the job.

In castings with walls less than 1¼ inches the use of cast iron chaplets may present a real danger. As the fusion of the chaplet with the melted iron is nil, the strength of the casting is weakened so much at that point that the shrinkage may cause a break. Breakage is favored by the rapidity with which cooling occurs, and by the chilling which results therefrom. Furthermore, the outward appearance of the casting will be spoiled.

Malleable iron chaplets can be bent to assume shapes and forms suitable to the job without running the risk

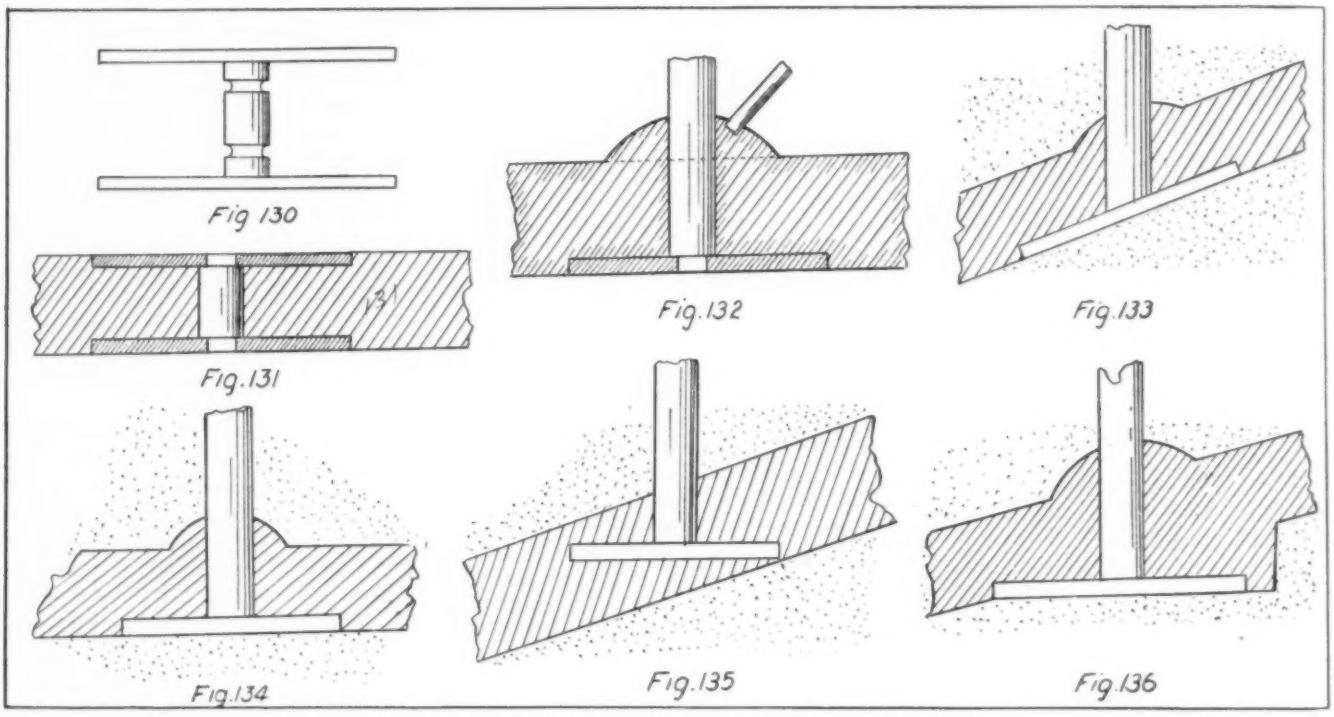


FIG. 130—CHAPLET WITH GROOVED STEM. FIG. 131—ORDINARY DOUBLE HEAD CHAPLET. FIG. 132—A BUTTON AND VENT ARE FORMED NEAR THE STEM. FIGS. 133, 134 AND 135—UNSATISFACTORY POSITIONS FOR SETTING CHAPLETS. FIG. 136—A SPECIAL RECESS IS FORMED IN THE CORE TO SEAT THE CHAPLET

of their breaking as sometimes happens with other chaplets.

The stamped chaplet with a central rod has all the advantages of the malleable iron chaplets. They are strong and can be made to conform to any shape desired to suit the job. Their use steadily is becoming more general.

Some chaplets are stamped out of sheet metal on a punch press and bent over to form two parallel faces with a spacer between. The whole is made out of one piece of metal.

In some foundries, chaplets are cut out and bent to a *T* shape with the central stem acting as a rod. These chaplets cannot be used advantageously except in vertical walls and at spots where the pressure is not too high.

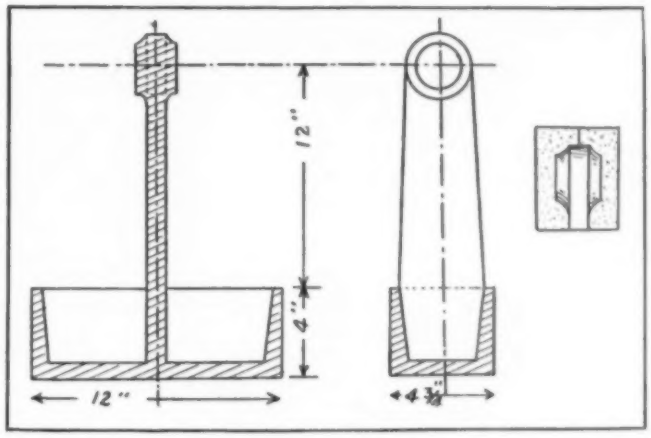
Made in Many Shapes

Cupped chaplets are drawn from a piece of sheet metal and made up in a great variety of shapes. The majority have the form of a hollow truncated cone, provided with two lugs and drilled through the center as shown in Fig. 128. Cupped chaplets are suitable only for small castings, having walls less than ¾-inch in thickness.

Of all the chaplets known, the riveted chaplets are by far the most generally used. They are low in cost and they are all that could be desired in the way of reliability.

Grooves sometimes are cut in the spacers to insure the tightness of the casting. Their efficacy in this respect is somewhat doubtful. The only real advantage of the grooving is that it prevents the chaplet from dropping out of the casting. This sometimes happens with smooth stem chaplets when the iron is poured cold. Disadvantage of the grooves is that they reduce the strength of the chaplet.

Chaplets are made in a great variety of shapes. Sometimes the spacer consists of a threaded rod. Again it may be stamped out and present a variety of corrugations on its outer surface. Plain single head chaplets are used in practically all cases on the upper face of medium and large cores. The end of the rod which projects above the cope is secured after the mold has been closed. Iron and steel wedges are inserted between the top of the chaplet stem and the rail supporting the loading weights. On repetition work the cope chaplets are driven against either sockets or projections on the bars and require no further attention.



FIGS. 141 AND 142—ILLUSTRATE METHOD OF FORMING THE BOSS ON THE END OF THE ARM IN A CORE

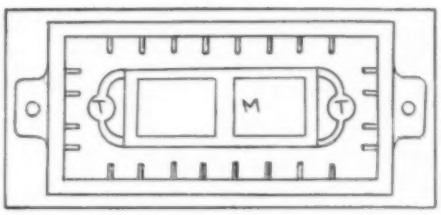


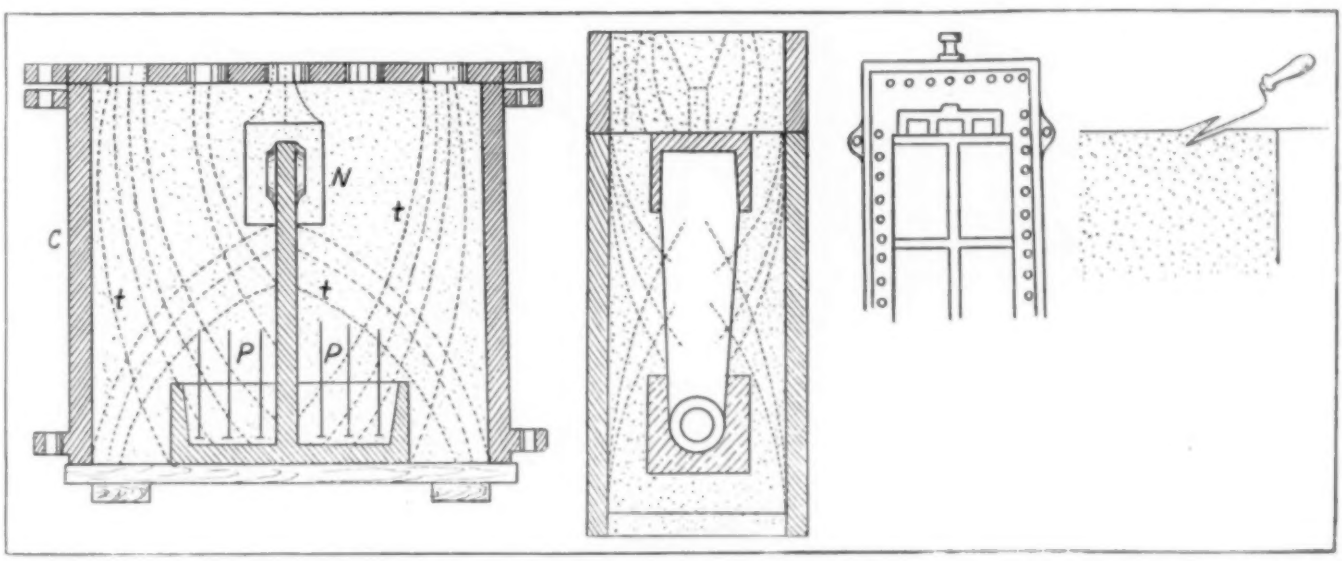
FIG. 140—SHOWING MOLD, GATES AND VENTS

When top parts of castings are to be machined, plain chaplets are preferably used. They are located on the pattern before any sand is placed in the cope and are thus rammed firmly in the proper position. In finishing the cope, a small button or boss is formed in the sand around the chaplet. The thickness is reinforced and a vent is made to facilitate the escape of gases at the time of pouring as shown in Fig. 129. When the chaplet has to rest against an oblique, curved or uneven surface on the core, a surface should be prepared at right angles to the stem. That is, the stem always should be perfectly plumb and the sheet metal head perfectly horizontal. This point is illustrated in Fig. 133.

Design Causes Use

Chaplets at best are a necessary evil. In the majority of cases, if the shape of the castings were better designed, one could contrive a sufficient number of openings which by permitting the placing of some blocking cores would lead to eliminating the greater number of the chaplets required.

With cores subjected to considerable pressure and where the casting must be perfectly tight, it is advisable to use cast iron stems from 1 to 2½ inches diameter, threaded on the portion imbedded in the casting. If a



FIGS. 137 AND 138—TWO SECTIONAL VIEWS OF DRAG SHOWING POSITION OF NAILS, VENTS, CORE AND PATTERN. FIG. 139—A RIDGE IS RAISED IN THE SAND TO PREVENT THE METAL FROM FLOWING OVER THE VENTS

test shows that the chaplet is loose it can then be taken out. Another rod a little larger in diameter can be screwed in to make a tight fit.

To mold the bracket with arms shown in Fig. 141, the following method can be used with good results. This piece is molded with the bosses downward to obtain the hollow section without the use of dry sand cores. Furthermore, even though the bosses were detachable from the pattern, it would not practically be possible to withdraw them through the stem after drawing out the pattern. By detaching the whole head of the stem with the bosses, it can be molded in three flasks, by making the first joint at the bosses and the second at the base of the support. It is preferable nevertheless to make the bosses and the whole head of the support in a dry sand core as shown in Fig. 142 molded in a box representing one half of the core. The two halves thus obtained are pasted together.

The pattern used in this instance is exactly like the casting, with the exception of the bosses which are left off. Detail of the various steps in the formation of the mold follow: Place the pattern on the molding board. Fill the hollow with facing sand. Stick some nails or pins into the sand. Press the sand down with the fingers. Adjust the drag in place, with the lugs turned toward the bottom. Spread a layer of facing sand about 1-inch thick in the bottom of the flask and against the pattern. Add 4 inches of floor sand.

Do not ram the first course hard. The rammer should be kept about 1½ inches from the pattern to prevent the formation of any hard spots. Fill a second course of facing and floor sand. Ram the second course. After the third course, the boss core may be placed. Slide it down until it comes to rest on the end of the pattern and then ram sand around it firmly. Continue tamping the sand until the drag is filled and then give a good round with the butt rammer. Level off with a straight edge or steel strip. Vent the mold toward the pattern as shown in Fig. 137. Roll the drag over on a soft bed of floor sand. This only applies to flasks without bottom boards. When the flask is set level, ram sand under the frame so that it will bear evenly all around. Use the trowel if necessary, to form a smooth, firm joint surface. Sprinkle with parting sand.

Ramming the cope does not involve any unusual features. Place gate pins on opposite sides for the pouring gate and for the riser. After the cope is lifted proceed as follows: Brush the parting sand from the joint. Use a bent wire to run vents from the joint under the pattern. With the point of a trowel, cut a series of small vent channels on the joint surface. Wet the sand lightly in the vicinity of the pattern. Rap the pattern moderately. Lift the pattern straight out of the mold. Cut the gates and risers *TT* Fig. 140 in a manner to fill the mold gently. Try the cope on and off is necessary. Shake blacking from a bag over the surface of the mold. With the trowel, raise a furrow in between the mold cavity and the vent holes in the joint as shown in Fig. 139. To cut a furrow properly, the blade of the trowel or of the lifter should be directed toward the outside, otherwise the risk is run of breaking away the edge of the mold. This furrow forms a barrier and stops any iron that might flow over a poorly matched joint. Flare out the pouring sprue and riser opening. Clamp the flask either on the lugs at the joint line, or, by the top and bottom edges of the flask.

Book Review

Bearing Metals and Bearings, by W. M. Corse, cloth, 6 x 9 inches, 384 pages, published by Chemical Catalog Co. Inc., New York, and supplied by THE FOUNDRY, Cleveland, for $7.15 and in London by the Penton Publishing Co. Ltd., 416-17 Caxton House, Wesminster, for 35s postage extra.

This volume is another of the excellent monograph series on scientific and technologic subjects arranged through the American Chemical society. It consists mainly of a bibliography of the literature on the subject of bearings and bearing metals from 1900 to 1928 and will be valuable to those interested. The book is divided into four sections which include history, bibliography, abstracts and tables The history deals with early developments, types of bearing metals, bearing types design, troubles and failures testing, lubrication, etc. The bibliography which occupies 106 pages is divided into bearing metals, bearings, and friction and lubrication. The abstract of papers which fills 206 pages contains short abstracts of the more important papers on the subject, and will indicate to the reader whether or not a more thorough study of a paper will be worthwhile for his particular needs. Those who have had to check back on literature on any subject will appreciate the abstract section. The book concludes with 14 pages of tables giving the properties of bearing metals.

Dr. Ancel St. John and Herbert R. Isenburger have organized the St. John X-ray Service Corp., 505 Fifth avenue, New York.

Testing Society to Meet

The thirty-third annual meeting of the American Society for Testing Materials will be held at the Chalfonte-Haddon Hall hotel, Atlantic City, N. J., from June 23 to 27. Sixteen technical sessions will be held during the five days of the meeting. The opening session will be held Tuesday, June 24 when the reports of the administrative committees followed by reports and papers devoted to research and methods of testing will be presented. The Edward Marburg lecture is arranged for Wednesday afternoon and will be presented by Dr. C. E. K. Mees, Eastman Kodak Co., Rochester, N. Y., on "Color and Its Measurement." The award of the Charles B. Dudley medal also will take place at that time. J. R. Townsend, W. A. Straw and C. H. Davis, joint authors of a paper, "Physical Properties and Methods of Test for Some Sheet Nonferrous Metals," which was presented at the annual meeting of the society in 1929, will receive the award.

The presidential address will be given by T. D. Lynch on Wednesday evening followed by the report of the executive committee by C. L. Warwick, secretary-treasurer. After the presentation of the reports, the new officers of the society will be introduced. The session will be followed by an informal dance and smoker.

Technical sessions of interest to foundrymen include, "Cast Iron, Wrought Iron, Magnetics, and Metals at High Temperatures," June 24 at 8 p.m.; "Steel," on June 25 at 9:30 a.m.; "Fatigue and Corrosion of Metals," June 26 at 9:30 a.m.; "Nonferrous Metals," June 26 at 8 p.m.; and "Symposium on Aircraft Materials," June 27 at 9:30 a.m. and 2 p.m.

Gives Recovery Figures

According to a bulletin on secondary metals in 1928 published by the bureau of mines, recovery of secondary metals increased from 1,028,080 short tons valued at $256,352,000 in 1927 to 1,118,800 short tons valued at $274,611,300 in 1928.

E. R. Norris, formerly general works manager, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been appointed assistant to the vice president in charge of manufacturing. He will be responsible for all plant facilities, manufacturing methods, cost reduction and inspection. He has been associated with the Westinghouse company since 1892.

The FOUNDRY Family Photograph Album

Upper Left

M. L. WALCHER

General Steel Casting Co., Baldwin, Pa.

Upper Right

J. F. NEWMAN

Lawrenceville Bronze Co., Pittsburgh

Lower Left

F. E. WHEELER

International Heater Co., Utica, N. Y.

Lower Right

R. HOIERMAN

Ohio Foundries Association Inc., Cleveland

SPECIFICATIONS FOR STEEL CASTINGS

FOR VALVES AND FITTINGS FOR HIGH TEMPERATURE SERVICE

(Continued from Data Sheet No. 814)

10. (a) Tension test specimens, and, when a bend test is specified, bend test specimens, shall be taken from test bars cast attached to the castings where practicable. If the design of the castings is such that test bars should not be attached to the castings, the test bars shall be cast attached to special blocks, a sufficient number of which shall be provided for each lot of castings. Test bars from which tension and bend test specimens are to be taken shall remain attached to the castings or blocks they represent through heat treatment and until presented for inspection. Test bars shall be provided in sufficient numbers to furnish the tests required in Section 11.

(b) If satisfactory to the manufacturer and inspector, tension test specimens may be cut from heat-treated castings, instead of from test bars.

(c) Tension test specimens shall conform to the dimensions shown in Fig. 1. The ends shall be of a form to fit the holders of the testing machine in such a way that the load shall be axial.

(d) Bend test specimens shall be machined to ½ x 1-inch in section with the corners rounded to a radius of not over 1/16-inch.

11. (a) One tension test and, when specified, one bend test shall be made from each melt in each heat-treatment charge and, when specified, from each casting weighing 500 pounds or over.

(b) If any test specimen shows defective machining or develops flaws, it may be discarded; in which case another specimen from the same lot shall be substituted.

(c) If the percentage of elongation of any tension test specimen is less than that specified in Section 7 (a) and any part of the fracture is more than ¾-inch from the center of the gage length, as indicated by scribe scratches marked on the specimen before testing, a retest shall be allowed.

12. If the results of the physical tests for any lot do not conform to the requirements specified, such lot may be re-treated, but not more than twice. Retests shall be made as specified in Sections 7 and 8.

13. The castings shall conform substantially to the shape and sizes indicated by the patterns and drawings submitted by the purchaser.

14. (a) The castings shall be clean and free from injurious defects.

(b) The castings shall not be peened to stop leaks.

(c) Defects which do not impair the strength of the castings may be welded by an approved process. The defects shall be cleaned out to solid metal, before welding, and when so required by the inspector, shall be submitted to him in this condition for his approval. All castings shall

(Concluded on Data Sheet No. 816)

SPECIFICATIONS FOR STEEL CASTINGS

FOR VALVES AND FITTINGS FOR HIGH TEMPERATURE SERVICE

(Concluded from Data Sheet No. 815)

be heat-treated after welding in accordance with the requirements in Section 3, except that with permission of the inspector, castings with minor welds need not be reheat-treated.

15. (a) The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manufacture of the castings ordered. The manufacturer shall afford the inspector, without charge, all reasonable facilities to satisfy him that the castings are being furnished in accordance with these specifications.

(b) If, in the case of important castings for special purposes, surface inspection in the green state is required, this shall be so specified in the order.

(c) All tests (except check analyses) and inspection shall be made at the place of manufacture prior to shipment, unless otherwise specified, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

16. (a) Unless otherwise specified, any rejection based on tests made in accordance with Section 6 shall be reported within twelve working days from the receipt of samples.

(b) Castings which show injurious defects subsequent to their acceptance at the manufacturer's works will be rejected and the manufacturer shall be notified.

17. Samples tested in accordance with Section 6, which represent rejected castings, shall be preserved for two weeks from the date of transmission of the test report. In case of dissatisfaction with the results of the tests, the manufacturer may make claim for a rehearing within that time.

Note 1.—This contemplates temperatures up to 750 degrees Fahr. (400 degrees Cent.); or at the discretion of the designing engineer higher temperatures with appropriate pressures may be used. Reference may be made to the dimensional standards for pressures and temperatures formulated by the sectional committee on standardization of pipe flanges and fittings, under the sponsorship of the Heating and Piping Contractors National association, Manufacturers Standardization Society of the Valve and Fittings Industry and the American Society of Mechanical Engineers, and organized under the procedure of the American Standards association. The hydrostatic test pressures shown in Section 9 were taken from the above standards.

THE FOUNDRY DATA SHEET, JUNE 1, 1930
Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Bill Says Hand Ladles Are Hard To Dry

By Pat Dwyer

SO FAR as I can remember no outstanding event in my career has happened in the month of May and yet out of all the 12 I think I like it the best. Occasional hints of summer appear in April, but frequently they are only false alarms. A day of balmy weather is followed by a piercing blast from the North Pole and down you go into the cellar again to stoke up the old furnace. One day you blithely tell your wife to give the overcoat, the mitts and the cap with the ear tabs to the old clothes man. On the following day, and for a week thereafter you make a vow every night that this absolutely is the last winter you ever will spend in a place where an eskimo would hesitate to build his igloo.

The days and the nights glide along as days and nights have had a habit of doing ever since the good old system of days and nights was invented and you are not surprised to note that the calendar marks the middle of May. No calendar is needed to remind you of the month. Almost over night your street has been transformed from an uninviting panorama of two rows of houses, into one of the magic gardens of Arcady, with the trees meeting above in a glory of soft green foliage and with the paved ribbon of a street extending between green velvet lawns on either side. If you were to meet Pan the piper tripping merrily along the sidewalk under the canopy of leaves, you would not experience the least feeling of surprise. You would greet him as one of the regular inhabitants and remark casually, "Hey, there, Pan ol' kid. How's the piping business panning out these days?" May brings the drooping spirits out of the slough of despond and gives one a renewed grip on the string of life. The string that threatened to slip out of the frozen fingers during the winter. Evidence of vigorous life abounds on every hand. The birds whistle gaily at their appointed task from daylight until dark. I wish the little blighters were muzzled until about 8 a. m. After that time they could whistle until they blew a gasket for all I care. Neighbors are out sprinkling the grass. The more ambitious are pushing the lawn mowers around to get properly hardened for the season. Leaves tremble softly without a sound in the gentle breeze and the eye rests with pleasure on brave displays of snowballs, tulips and daffy-down-dillies. Oh, well, daffodils if you insist, but as daffy-down-dillies they were known when first I made their acquaintance and daffy-down-dillies to me they always will remain.

Somewhere along in the month of May you hang up the swing and set out the porch furniture and promptly forget the noble vows you made to join the birds in the fall and fly away until you could not fly any farther. You light your pipe and are content to let the rest of the world go by.

One night recently Bill came over to help me spend a quiet hour. He cocked his feet up on the veranda railing and tipped his chair back at an angle that I am sure would not meet the approval of dear old Euclid, if by any chance he happened to drop around while collecting material for a new best seller. In fact the angle would not meet with the approval of any person with the possible exception of one of these sad faced gentlemen, yclept morticians, whose success in life is in direct ratio to the mortality percentage among the inhabitants.

If I have warned Bill once, I have warned him 50 times that some day he will tip back an inch too far. Some day even the counter balance of his big feet, drooping over the railing, will not save him from a spill.

"What do you care?" he invariably replies to this free and friendly hunk of advice. "What do you care if I tip over—and of course that includes the chair—that will be only my hard luck. You won't feel it."

"No?" I reply, with just the proper tinge of a rising inflection. You know, just like that. "No? If you tumble backward and four or five of the chair rungs, braces and bars, penetrate your system to a great and painful depth, from as many different angles, who, I ask you, who is going to have the job of pulling them out of you? Who is going to mop up the gore? Who is going to plug the holes so that you may breathe your last peacefully instead of giving a correct imitation of the average foundry bellows? Just poor little me," I said. "That is who will have to do all the dirty work. Just me and nobody else! I am not used to it, and what is more to the point—Say, are you listening?—What is more to the point, I have no desire to acquire familiarity. This is a free country. If you want to commit hari-kari, that is all right with me—

A LITTLE MORE STUFFING WOULD NOT HURT HIM

but—and this is the only important feature—if you want to make a spectacle of yourself, I wish you would take a run down back of the vinegar works.

"You can imagine my embarrassment on picking up the morning paper and finding my picture on top of a half column story headed: Shocking Fatality. Body of Well Dressed Man Stabbed in the East End with a Chair. Prominent Citizen Held in Connection with Shady Affair. Veranda a Veritable Shambles. Shows Evidence of Terrific Struggle. Police Suspect Foul Play. Scout Story of Suspected Man. Apparently of Feeble Mind.

"If the fall does not polish you off immediately I can see a picture of you creeping around here like one of these what-do-you-call-'em, porcupines, with wooden splinters, skewers, and slivers projecting from all parts of your person like so many quills. With so many punctures, the hide practically will be useless from a taxidermist's viewpoint. Otherwise I might consider the advisability of having it stuffed and presented to the museum of natural history. If I might suggest a caption for the front of the glass cage how does *The Fall of the Wild* strike you? Maybe the simple and dignified title *The Chairman* would be more appropriate."

FROM AN OLD HUNTING PRINT: *STALKING THE QUARRY*

Contrary to his usual habit, Bill said nothing. He merely tipped his chair back another half inch and exasperatingly continued smoking in silence.

With the experience gained through long practice and without the formality of taking aim, also with the pipe stem firmly clinched between his teeth, he spat accurately and expertly between two of the upright standards in the railing into a long box that eventually—it is hoped—will contain a gorgeous display of nasturtiums.

Prompted by advice from headquarters, on a former occasion, I had hinted to Bill that this practice might have an adverse effect on the growing plants. They need care and attention and gentle handling in the early stages of growth.

He always waved the objection aside and told me he really was doing me a favor. Well, kinda dividing the favor up among me and the plants. The touch of moisture was what the plants needed and the slight infusion of nicotine was an antiseptic, a germicide, an insecticide or whatever it is you call this here now stuff that puts 'em all—the bugs, not the plants—on the blink.

Killed off all the bugs and insects, he claimed, and all that kind of thing and thus saved me hours and hours of back breaking labor in removing the pests from the leaves with a pair of pliers, or with the bare fingers if I was not too fussy.

Greenhouse people, he said, regularly sprayed their plants with a nicotine solution for that express purpose. (Note. I must check up on that statement some time.) It seems highly improbable that tobacco is prostituted for such a purpose.

When this theory was brought to the attention of the lady who assumes a proprietary interest in the plants, because forsooth, she happened to prepare the soil in the boxes and planted the seeds, I say, when this theory of fumigating the plants was brought to her attention, she indulged herself in the luxury of a short sneery laugh. Just a single Ha-ha!

"Going to kill off all the insects by squirting tobacco juice on them is he?" she repeated. "He can't lose out on a proposition of that kind. If he can't poison them, he will drown them. Perhaps he thinks the box is the basin of a fountain and the plants are water lilies."

This was a view that previously had not occurred to me, but in the present instance before I could sound Bill out on the subject, the inevitable happened.

He half turned in the chair and commenced to say something about the center of gravity. Then over he went, with a bang. For a few seconds the air was filled with flying arms and legs, animate and inanimate. In my role of prophet, who sees his prediction fulfilled I maintained an attitude of strict neutrality.

I manfully resisted the temptation to say, "I told you so!" Also with equal fortitude I refrained from asking him if he was hurt. Far be it from me to butt into any person's private affairs. He had engineered his humpty-dumpty act without any assistance on my part. Therefore I reasoned, quite logically, I hope, he was entitled to the next move.

Outside of a startled ejaculation, characterized more by astonishment than piety, when he felt himself going over, Bill said nothing until he had unscrambled himself and once more resumed his former position, feet on the railing, and the chair tipped back.

"That's the trouble with those trick chairs," he said. "You can't depend on 'em. Made me think for a minute that I was in Heinie Kaboobler's famous joint on South State street, Chicago. I have heard nothing of Heinie and his cute assortment of thrillers in recent years. Another sacrifice to the modern method of irrigation.

"Heinie's plant flourished for many years in the favorable malt and spirituous atmosphere which prevailed without let or hindrance in pre-volstead Chicago. From occasional reports in the daily press, one gathers the general impression that the sale and consumption of alcoholic beverages are not entirely unknown at the present. However, the present method of distribution was fatal to Heinie. Publicity was his greatest asset. When the eighteenth amendment to the constitution converted this asset over night into a liability, why, Heinie folded his tents like the Arab and silently stole away. For many years his saloon with its many trick features was one of the sights of the city. No visitor was allowed to depart until he had been taken down State street, south of Van Buren, and induced to enter Heinie's haven of refuge.

"Regular customers were treated in orthodox style. They walked in, ordered the species and amount of revivifier to suit their particular requirements, absorbed it in one long gulp, or in a more leisurely manner depending on their condition of aridity, removed the surplus from the bush by a skillful application of the index and second finger and either repeated the operation *ad lib* or paid the score and departed, refreshed and rejuvenated.

"The special features were reserved for the casuals, the strangers or the innocent victims brought in by designing friends. A wink to the gent in the white apron was sufficient to bring all the stage properties into play.

"The victim received his first shock when he placed one foot on the brass rail. That particular section of the rail promptly collapsed. The bartender filled a schooner with beer and then casually directed the patron's attention to an oil painting over the bar. When the customer reached for

the glass a few seconds later, he found that the liquid had leaked through a hole in the bottom. The attendant filled him a second shuper and kept his finger over a hole in the side. The thirsty one lifted the scuttle to his lips and while he was drinking the contents, a small stream trickled down the front of his vest.

"He was led to the back of the room to view a picture, and a roll of canvas was dropped on his head. He was taken up stairs to see the museum and when he reached the top, the stair steps folded up and he slid to the bottom. The friend placed him in a chair to view an album of smuggled prints and the chair promptly collapsed.

"He was asked if he would like to see the collar worn by the first mayor of Chicago and then was shown a dilapidated horse collar with the straw sticking out through it. A green blind over the door had a tin cup attached to it and bore a sign 'Pity the Blind.' A section of the bar was electrified. When the customer reached for his change he got a shock that curled his hair. The cash register was equipped with a cow bell that jangled alarmingly when a sale was rung up. A side table ornamented with a Free Lunch sign carried a lavish display of food in the natural state, wheat, oats, rye, barley, rice, tapioca and Indian corn.

"The place was humble and the entertainment was crude according to present day standards, brought about to a great extent by the radio, but it is safe to say that Heinie's name was more familiar than that of the mayor of the city. Tourists doing a hurried jaunt of America in 60, 30 and in some instances, 20 days, retained a vivid recollection of Heinie's little friendly home nest, long after they had forgotten whether Chicago is located on Lake Superior or Lake Ontario, or whether it is east or west of the Rocky mountains."

"Well," I said, "I never was in there, but according to all accounts it was a pretty hot joint."

"Hot is the word," said Bill, "so long as it is used in a figurative sense. However, talking about hot joints and one thing and another reminds me of an inquiry I had lately from a lad who is contemplating the erection of a room or an oven of some kind for drying his hand ladles. He mentioned the fact that available space was limited and he was wondering if it is practical to employ hot air as a heating medium. He wrote that he would appreciate my opinion on this point and upon any other I might care to touch upon in connection with the subject of drying ladles in a stove foundry.

"I do not understand what bearing the available space has on the question of what heating medium to employ. He will require an oven of a certain size to accommodate a definite number of ladles. It will occupy a certain space and that space will not be increased whether he uses coke, coal, gas, oil or electric current. The firing chamber for the coke and coal either will be under the floor or inside near one end. Gas usually is burned through a great number of

PROHIBITION STOPPED ALL THIS KIND OF ROUGH STUFF

small jets from a common supply pipe laid on the floor of the oven at each side. Oil is burned through a suitable nozzle close to the center of the floor at one end of the oven or through several small nozzles at various points on the floor. Coils for generating heat from electric current are attached to the side walls of the oven.

"His inquiry as to the practicability of employing hot air is a rather vague basis on which to frame a definite answer. All ladles are dried by hot air with the possible exception of those that are dried occasionally by placing them directly in the fire. Hot air at approximately 500 degrees Fahr. is required and if a temperature of 600 or even 700 degrees can be developed the drying will be more satisfactory. Ladles are more difficult than cores to dry, partly on account of the material of which the daubing is composed and partly because the moisture continually condenses on the inside of the shell. All hand ladles should be provided with vent holes for the escape of steam but as a matter of fact those that are equipped in that manner are in a decided minority. This is particularly true of cast iron hand ladles usually made in the foundry.

"The difficulty of properly drying ladles is apparent in nearly every foundry where they are dried in a special oven or in the regular core oven. Almost invariably before they can be used, they must be filled or partly filled with molten iron which is allowed to remain in them until it stops boiling on account of a damp bottom. The lining apparently may be dry but the instant the bottom is covered with iron the boiling action commences and proves that a certain amount of moisture still is present.

"If he is thinking of piping hot air from an ordinary heater, the idea is not practical because the temperature will not be raised to a point where the ladles will be dried properly. Hot air developed by driving a current of air across a bed of fuel by a fan that discharges into the oven will be found perfectly satisfactory. Where only a few hand ladles are employed the problem of drying them is not serious. They are given a preliminary drying either in the core oven, or by building a small wood fire in them. In many instances they are dried by placing them in an inverted position over a large ladle in which a large fire has been built to dry the lining. Afterward the molder catches a few inches of iron in the hand ladle and swirls it around until it ceases boiling. Then it is spilled out and the ladle is in condition for pouring iron in the molds. Steel foundries have developed the best method of drying ladles, either small or large. This is another case where necessity was the mother of invention. Steel ladles must be hot as well as dry. The usual method of drying the ladles is to place them over a series of openings in a brickwork chamber fired with oil or gas.

Announces New Members

The Gray Iron institute, Terminal Tower building, Cleveland, has admitted the following firms to membership in the association: W. F. Mosser & Son, Allentown, Pa.; Victor Foundry Co., Peoria, Ill.; Copper-Clad Malleable Range Co., St. Louis; Webb City & Carterville Foundry & Machine Co., Webb City, Mo.; Syracuse Foundry, Inc., Syracuse, N. Y.; Columbia Iron Foundry, Philadelphia; and Excelsior Foundry Co., Belleville, Ill.

Belgians Gather at Liege

Convention Will Be Held in Connection with International Exposition—Many National Exchange Papers To Be Presented

THE program of the foundry convention which will be held at Liege, Belgium, in connection with the international congress of mines, metallurgy and geology is of considerable interest. The convention will be held from June 23 to 27 under the chairmanship of J. Leonard, president of the Association Technique de Fonderie de Belgique. Exchange papers will be presented on behalf of the American Foundrymen's association, the Institute of British Foundrymen, the Association Technique de Fonderie of Paris, the Verein Deutscher Eisengiessereien Giessereiverband of Germany, the Czech technical foundry association and the Dutch technical foundry association.

Will Visit Exhibition

The congress will be opened formally on Monday, June 23, at 10 a.m. In the afternoon an official visit will be made to the international exhibition which is being held at Liege and which will include a special section devoted to the foundry industries. In the evening of the first day there will be a reception by the governor of the province of Liege at the Provincial palace.

On the morning of Tuesday, June 24, the first technical session will take place, and the papers discussed will come under the heading of "Cast Iron Testing Methods." In the afternoon visits will be made to the foundries of the Cockerill works, or Societe Metallurgique Ougree-Marihaye, or Societe des Tubes de la Meuse. In the evening there will be a reception at the college by the burgomaster and aldermen of the City of Liege.

The second technical session will be held in the morning of Wednesday, June 25, the papers dealing with high-duty cast irons. In the afternoon the laboratory of the National Manufacture of Arms will be visited. This will be followed by the meeting of the international committee of foundry associations. In the evening of the same day the banquet of the international congress of mines, metallurgy and geology will be held. The banquet will take place in the hall of the Festival palace of the exhibition.

On Thursday morning, June 26, a technical session dealing with malleable cast iron will be held, and in the afternoon of the same day another session will deal with sands and other subjects. The convention will be closed formally at 5 p.m., and in the evening the banquet of the Association Technique de Fonderie will take place. The whole of Friday, June 27, will be devoted to visiting the Ardennes mountains. The list of papers to be presented at the congress is as follows:

Lists Papers

(a) Cast Iron Testing Methods. "Contribution To the Study of Methods of Testing Cast Iron," by H. Thyssen, University of Liege; "Application of the Shearing Test To the Control of Cast Iron Parts," presented by the scientific committee of the Association Technique de Fonderie de Belique; "New Machine for Bending, Shearing and Hardness Tests to Be Effected on Test Pieces Taken from the Casting," by H. Thyssen and J. Bourdouxhe, Compagme Generale des Conduites d'Eau, Liege; "Shearing Test by Punching—Its Application To the Control of Thin Pieces," by A. Deleuse, National Manufacture of Arms, Herstal.

"Consideration of the Results of Various Cast Iron Tests, Especially the Tests Made in Czecho-Slovakia," exchange paper of the Czech foundry association, presented by Prof. Dr. Ing. Fr. Pisek, Czech polytechnic school of Brno; "Consideration of the Respective Advantages and Disadvantages of the Various Methods Employed in the Production of Steel in the Steel Foundry," exchange paper presented on behalf of the Institute of British Foundrymen by J. W. Deschamps, Kryn & Lahy (1928), Ltd., Letchworth; "Electrolytic Iron," by R. Dupuis, Fonderia Milanese di Acciaio, Milan.

(b) High-Duty Cast Irons. "Some Problems Relative to Quenched Cast Iron," by Paul Ropsy, Societe Belge Griffin, Antwerp; "A Study of the Furnaces Utilized in Cast Iron Foundries," exchange paper of the Verein Deutscher Eisengiessereien Giessereiverband, presented by Dr. Ing. Geilenkirchen, director of the German association; "Considerations of Certain Physico-chemical Modifications of So-called Pearlitic Cast Irons," exchange paper of the Association Technique de Fonderie of France, presented by A. Le Thomas, Ecole Superieure de Fonderie, Paris; "Nickel Cast Irons—Their Study and Recent Applications," by F. Renaud; "High-Duty Cast Irons—Recent Improvements," by R. Lemoine, Ecole Superieure de Fonderie, Paris; "Factors That Influence the Quenching Properties of Cast Iron," by A. L. Norbury, British Cast Iron Research association.

(c) Malleable Cast Iron. "The Use of Pulverized Fuel for Heating in German Malleable Foundries," by Dr. Ing. Rudolf Stotz; "Recent Developments in the American Malleable Foundry," by H. A. Schwartz, National Malleable & Steel Castings Co., Cleveland, O.; "Modern Development of the Malleable Foundry," by Prof. E. Piwowarsky, Giesserei Institut, Aachen; "Evolution of the Malleable Foundry in France," by Raymond Gailly, Establissements Gailly Freres; "A Few Remarks on a Foundry Defect," by M. Kagan and R. Deprez; "Contribution To the History of the Malleable Foundry in the Liege District," by Rene Deprez, general secretary of the Belgian association; "Improvements in the Manufacture of Malleable," by Enrique Touceda, Malleable Iron Research institute, Cleveland, O.

(d) Sands and Miscellaneous Matters. "The Control of Foundry Sands," exchange paper of the American Foundrymen's association, presented by H. W. Dietert, United States Radiator Corp., Detroit, Mich.; "Present Methods of Testing and Control of Foundry Sands," by A. Decleuse, National Manufacture of Arms, Herstal; "Practical Data on the Drying of Molds and Cores," by A. Debar, Ecole Superieure de Fonderie, Paris; "Notes on the Pouring of Pulleys and Fly-Wheels," presented by the technical committee of the Association Technique de Fonderie de Belique; "The Use of Fluorspar in the Cupola," exchange paper of the Dutch technical foundry association, presented by D. Deuvorst, N. V. Ijzergieterei en Emaillerfabriek Diepenbroek et Reigers, Ulft; "Production and Application of Light and Very Light Alloys in Italy," by A. W. Bonaretti, Societe Isotta Fraschini; "Simplified Practice in the Metallography of Cast Irons," by F. Girardet, St.-Die (France).

Book Review

The Principles of Metallurgy, by John L. Bray, cloth, 568 pages, 6 x 9¼ inches, published by Ginn & Co., Boston, and supplied by THE FOUNDRY, Cleveland, for $5.80 plus 15 cents postage, and in London by the Penton Publishing Co. Ltd., 416-17 Caxton House, Westminster, for 19s, postage extra.

Knowledge of metallurgy is of vital importance in engineering practice. Modern industry uses metals to such a great extent that every engineer should be familiar with the properties, methods of treatment, and limitations of the common metals. The field of metallurgy has many rami-

fications and it hardly can be expected that any one volume can cover more than the mere essentials of the subject. However, the author recognizes this and states that the work is arranged to present in a clear, concise manner, the principles involved. The book is divided into 17 chapters and contains many illustrations, diagrams and tables that amplify the text. The first chapter covers ores and metals and the second deals with refractories. Fuels, roasting and slags and fluxes are described in the third, fourth and fifth chapters while chapter six discusses the preparation of ores. Chapters VII, VIII, IX, X, and XI relate to copper, lead, zinc, gold and silver respectively. Chapter XII is devoted to aluminum and magnesium while bismuth, tin, antimony, arsenic and mercury are grouped together in Chaper XIII. Manganese, chromium, nickel and cobalt are discussed in Chapter XIV, and iron and steel manufacture is described in Chapter XV. Metallography and sampling and schedules are covered in the last two chapters found in the book.

Pacific Foundries Adopt Standards

By S. M. Truitt

CONSIDERABLE progress is being made by west coast foundry organizations in consolidating their activities. The East Bay Foundrymen's association, consisting of foundries in Sacramento, Stockton, Oakland, Richmond, Alameda, San Leandro, San Jose, South San Francisco, and San Francisco has been holding dinner meetings once a month when matters of interest to the foundries are discussed. On the San Francisco side of the bay the Pacific Coast Founders association has been in existence since 1926 and is endeavoring to obtain the co-operation of the foundries in various matters affecting the industry. Under the auspices of the state chamber of commerce the two associations and the individual foundries, as well as other lines of industry, are offered an opportunity to express themselves at the Iron, Steel, and Allied industries meeting held at Del Monte usually in January or February of each year.

In the 1929 meeting of Iron, Steel, and Allied Industries the matter of standardizing patterns was taken up and the American Foundrymen's association standard was accepted. The Pacific Coast Founders association, East Bay Foundrymen's association, California Metal Trade association, Metal Trade Manufacturers association of Southern California, and the California Development association all have accepted this standard and have been instrumental with the eastern organization, in having this chart accepted as standard by the department of commerce.

Standard specifications in accordance with the recommendations of the American Society of Testing Materials was brought up during the year and the same group of organizations was instrumental in having the proposition adopted.

Signatures have been obtained from the majority of the foundries in the state accepting the standard pattern and marking code and the standard specifications, and at the present time an educational campaign is being carried on with the casting user to have him make his patterns and write his specifications in accordance with these standards.

At the last Del Monte meeting of the Iron, Steel and Allied industries the writer proposed the standard sales agreement and code of trade customs in accordance with the recommendations of the Gray Iron institute. This matter was referred to the first meeting of the simplified practices committee which was formed at the instance of the department of commerce, and which has two chairmen. One chairman acts for the southern California industries and the other for the northern California industries. The foundries committee for the northern group consists of the following:

Charles J. P. Hoehn, chairman of the northern group of foundries, elected at the recent Del Monte meeting. Mr. Hoehn is president of the Enterprise Foundry Co. operating foundries in San Francisco, South San Francisco, and Richmond. He is also president of the Pacific Coast Founders Association.

S. Russell, president of the Phoenix Iron Works, Oakland, Calif.; also member of the East Bay Foundryman's association.

W. B. Vestal of the Imperial Mineral Products Co., San Francisco and Oakland; also a member of the East Bay Foundryman's association.

S. Truitt, manager of the Pacific Coast Founders association, San Francisco.

At a meeting of the East Bay Foundrymen's association held Wednesday evening, March 12, the writer outlined the program, and read to the members the standard sales agreement of the Gray Iron institute. A resolution was passed authorizing me to report at the March 17 meeting of the simplified practices committee that the East Bay Foundrymen accepted the standard sales agreement of the institute, and will do all in their power to co-operate with the committee in having this standard adopted by the department of commerce and the Pacific coast foundries.

The Pacific Coast Founders association adopted the Gray Iron institute standard sales agreement prior to the Del Monte meeting, and is doing everything possible to co-operate with the various organizations in urging the adoption of this code of ethics which has been needed on the coast for a long time. As the foundries in the east also are much interested in a standard sales code, it is believed that this sales agreement will in time become the accepted standard of the department of commerce for use throughout the United States.

The foundries of southern California are holding meetings under the direction of the southern foundries group chairman, and the standard sales agreement of the Gray Iron foundries is under discussion.

Forms New Subsidiary

Armstrong, Whitworth Securities Co. Ltd., London, England, has organized Sir W. G. Armstrong, Whitworth & Co. Ltd., ironfounders, to take over the operations of the manufacture of castings and pig iron formerly carried on by Sir W. G. Armstrong, Whitworth & Co. Ltd., engineers. The new company is capitalized at $650,000. The plant and equipment of the foundry is modern and is capable of manufacturing castings which weigh as much as 35 tons for general engineering work. The company also produces pig iron.

Ransom Mfg. Co., Oshkosh, Wis., manufacturers of grinding machinery, has changed its name to the Ransom Grinding Machine Co. No changes will be made in the organization.

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The Shakeout

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CHARLES VICKERS
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¶ Bound for a Hoss Trade

AN OLD downeast Yankee is said to have remarked, "When two fellahs meet and each one likes the t'others hoss better 'n he does his own, there's just bound to be a hoss trade." Right. Whether it be horse flesh or bonds, the acquisitive urge underlies almost every transaction. It makes all commerce possible and marks the path of progress. Foundrymen are seeking to interest engineering schools in better teaching of foundry subjects and in disseminating knowledge of castings. Colleges are striving to give their students a better conception of industry, and to provide the best teaching of properties of engineering materials.

THE ingredients of a good "hoss trade" are found in this situation. At the Cleveland American Foundrymen's association convention, as reported elsewhere in this issue, a committee presented and the annual meeting referred to the board of directors a resolution which boils down the foundry viewpoint in these words.

> Therefore, the committee recommends that the American Foundrymen's association urge all schools of engineering to provide the medium by which students of engineering may acquire as complete knowledge of the foundry industry in all its phases as relates to the *design*, *manufacture* and *use* of castings as time and proper facilities will permit.
>
> This committee recognizes that all colleges of engineering do not have the necessary facilities. There are means, however, for the training of students through co-operative effort between the colleges and industries and this committee recommends that the American Foundrymen's association lend its aid to the development of plans for such co-operation.

In other words the foundry industry needs educated men of two classes, namely, those who by training may enter foundries and complete their knowledge of the technique of castings manufacture to the betterment of the industry and next, engineers who have a proper concept of the design and use of castings.

TO PRESERVE the homely comparison, without in any manner associating an eminent educator with the New England trader, the second element is found to be present in the address of Dr. W. E. Wickenden at the annual banquet of the American Foundrymen's association. This gentleman, the president of Case School of Applied Science, spoke of the desire of modern engineering schools to give courses and provide the proper facilities to carry on education most needed in the modern industrial world. Without depreciating what may have been done along the lines of education in foundry lines a closer co-operation should be established. Through the American Foundrymen's association, the great technical organization of the industry, this co-operation may be established.

¶ Let in the Light

USERS of silica sand, for molds, for furnace bottoms or for any other of its many applications, will view with a great deal of interest the recent action of a prominent silica sand producer in establishing an elaborate chemical and physical laboratory for intensive study of sand. Silica sand forming the bottom of a steel melting furnace is subject to even more severe service than sand in a mold. In a typical analysis of a furnace bottom sand, the bond contains approximately 60 per cent silica and 25 per cent aluminum oxide. The bond in a bottom sand should be highly siliceous to permit the sand to fuse at a comparatively low temperature, necessary in furnace practice, while the high silica content fuses at a much higher temperature.

GRAIN size, angularity and angle of rest must be considered, but the combination cannot be defined within any practical specifications. Even a sand physically satisfactory may be unsuitable on account of its chemical composition. The melter attaches great importance to the ease with which sand lies at a steep angle on the banks. Small amounts of impurities on the surface of the grains will cause friting and assist in the formation of a hard, steep bank. A greater amount prevents the cohesion of the grains and the sand if soft. Since small amounts of impurities in the mass of the grain, accelerates the changing action, it is clear that the interior of the grain, at least, should show a high degree of purity. Experience shows that it is impossible to carry out the melting process on a pure silica hearth. Softening action of the fluid slag counteracts the tendency of the hearth to crack while cooling. An exhaustive series of experiments at the new laboratory should throw light on many features that up to the present have puzzled the melter and the molder.

Comings and Goings of Foundrymen

Men of the Industry, Whose Activities Are Making Foundry History

JAMES L. Mahon, superintendent, American Car & Foundry Co., Detroit, has been elected president of the Detroit Foundrymen's association. Mr. Mahon was born in Detroit on Feb. 7, 1881. He entered the employ of the American company on Sept. 26, 1896 as car clerk. Later he held the positions of superintendent clerk, storekeeper and special traveling representative. Only July 14, 1912 he was appointed superintendent. In September, 1926, when Detroit was host to the American Foundrymen's association and the International Foundrymen's congress, Mr. Mahon was appointed chairman of the ladies committee. He was elected president of the Detroit association at the May 2 meeting.

J. W. Henry, metallurgist, Electro Alloys Co., Elyria, O., manufacturers of high temperature heat resisting alloys, has been appointed general superintendent.

A. L. Boegehold, metallurgist, General Motors Corp., Detroit, addressed the May meeting of the New England Foundrymen's association on the quality of pig iron and castings as affected by blast furnace practice. The talk was illustrated.

Robert J. Anderson has resigned as vice president and director of the Fairmont Aluminum Co., Fairmont, W. Va. Dr. Anderson is well known in the aluminum casting industry and received the W. H. MacFadden gold medal of the American Foundrymen's association in 1925 for his contributions to the association and for his scientific work in connection with the aluminum casting industry. He received his education at Case School of Applied Science, Cleveland, and from the Massachusetts Institute of Technology. He was graduated from the former institution with a degree of bachelor of science in 1914 and received degrees as metallurgical engineer in 1917 and doctor of science in 1925 from the latter. He served as instructor in metallurgy at the Missouri School of Mines, Rolla, Mo., for one year. He resigned that position to become chief metallurgist with the Cleveland Metal Products Co., Cleveland, and in 1918 accepted the position as research metallurgist with the bureau of aircraft production. Later he was appointed metallurgical engineer in charge of the nonferrous

JAMES L. MAHON

metals section of the United States bureau of mines, Pittsburgh, where he remained until 1924.

British Founders Will Hold Annual Meeting

The twenty-seventh annual convention of the Institute of British Foundrymen will take place at Middlesbrough, June 17 to 20. On the evening of the first day, the general council meeting will be held at the Constantine Technical college. The meeting will be followed by a reception. The conference will commence on the morning of June 18, at Constantine college with an official welcome by the mayor of Middlesbrough, which will be followed by the annual general meeting. Visits will be made to Dorman, Long & Co. Ltd., Smith's Dock Co., Ltd., and Head, Wrightson & Co. Ltd., in the afternoon and in the evening the annual banquet and dance will be held in the Constitutional hall, Stockton-on-Tees.

The conference will continue during the morning of June 19. A river trip to Tees-Mouth, and works visits to Dorman, Long & Co., Ltd., Port-Clarence, Richardsons, Westgarth & Co. Ltd., and Imperial Chemical Industries, Ltd., have been arranged for the afternoon. Members will gather at the Middlesbrough opera house in the evening for entertainment.

On Friday, June 20, a motor coach excursion over the moors to Whitby, has been arranged, returning by the coast road to Saltburn, where the delegates and ladies will be entertained at a garden party and tea.

The following papers will be presented at the meeting: American exchange paper, "Developments in the Use of Briquetted Borings for Cupola Melting," by F. J. Walls; Belgian exchange paper, "The Preparation of Materials for the Converter When Used for Steel Castings," by J. Leonard; French exchange paper, "The Making of Iron Castings for Heating Apparatus, Stoves, and for General Building Purposes," by H. P. Magdelenat; "The Economic Utilization of British Pig Iron Resources," by C. H. Ridsdale and N. D. Ridsdale; "The Founding of Bronze Gear Blanks," by F. W. Rowe; "The Future of the Side Blown Converter in the Steel Foundry," by J. Deschamps; "The Utilization of Compresed Air in Steel Foundry Practice," by T. W. Barley; "The Production of Large and Medium Sized High Class Iron Castings," by W. Scott; "Reclamation of Oil Sand Cores," by Frank Hudson; "The Factor of Personnel With Regard to the Future of British Foundry Practice," by Douglas H. Ingall.

Buffalo Iron Founders Organize Chapter

A group of gray iron foundrymen in Buffalo have organized the Niagara Frontier chapter of the Gray Iron institute. At a meeting held April 25, the following members were elected officers of the chapter: President, P. J. Krentz, Buffalo Foundry & Machine Co.; secretary and treasurer, J. . Pohlmann J. W. Pohlmann Foundry Co.; vice president on cost and accounting, L. C. Vaklier, Buffalo Foundry & Machine Co.; vice president on research and mechanical practice, M. W. Pohlmann, J. W. Pohlmann Foundry Co.; and vice president on merchandising and publicity, R. J. Limburg, Steel Drum Accessories Corp., all of Buffalo. The election of officers was followed by an address by A. J. Tuscany, manager of the institute, who outlined the aims and progress of the parent organization.

Obituary

John E. Charles, sales engineer, Grindle Fuel Equipment Co., Harvey, Ill., a subsidiary of the Whiting Corp., died at his home in Rochester, N. Y., May 2. He was 35 years of age. Prior to his affiliation with the Grindle company, he had been associated with the Pfaudler Co., Rochester, N. Y.; the Symington Co., Rochester, N. Y.; and the American Radiator Co., Buffalo.

Charles E. Young, 53 years old, vice president of the Imperial Brass Mfg. Co., Chicago, since 1915, died recently at his home in Park Ridge, Ill. Mr. Young had been associated with the brass manufacturing industry for a number of years. He formerly was director of the Ohio Brass Co., Mansfield, O., later returning to Chicago where he operated an advertising agency.

George B. Shepard, president, Eberhard Mfg. Co., Cleveland, died May 2. He was born in 1865 at Montpelier, Vt., and entered Harvard university in 1881 from which he was graduated in 1885. He entered the employ of the Eberhard company immediately following his graduation and was connected with that company for 45 years. He became president of the company in 1924.

M. Hoke Gottschall, 52, purchasing agent for the Standard Oil Co. of Pennsylvania, died May 17 at his home in Mt. Lebanon, Pa. He formerly was associated with the state of Pennsylvania as chief of the bureau of statistics and information and later with the Pennsylvania Lubricating Co. which now is a Standard Oil subsidiary.

E. C. Landgraf, for the past fifty years actively engaged in the foundry industry, died recently at Rockford, Ill. He was foreman at the Arcade Mfg. Co., Freeport, Ill., for several years and later was superintendent of the Brillion Iron Works, Brillion, Wis., 1917-1918. He resigned from the latter position to become superintendent of the Liberty Foundry Co., Rockford, Ill., which position he held for the past eleven years. He was a member of the American Foundrymen's association, and well known for his success in the casting of individual piston rings and light gray iron.

Whiting Corp. Acquires Birmingham Plant

Purchase of the Plant of the Goslin-Birmingham Mfg. Co., Birmingham, Ala., by the Whiting Corp., Harvey, Ill., manufacturers of cranes, foundry equipment, etc., has been announced. The purchase involves upward of $1,000,000. Plans of the new owners embrace developing the shops and greater employment of workmen.

The Goslin-Birmingham company is one of the largest foundry and machine shops of the South. Immediate possession will be taken of the shops without a letup in operations. The Whiting Corp. probably will enlarge the facilities of the plant for the manufacture of cranes.

Foundry Association Directory

American Foundrymen's Association

President, FRED ERB, Erb-Joyce Foundry Co., General Motors building, Detroit; executive secretary-treasurer, C. E. HOYT, 222 West Adams street, Chicago; technical secretary, R. E. KENNEDY, 222 West Adams street, Chicago.

Associated Brass Founders of New England

President, GEORGE W. THORNBURG, Crescent Park Brass Foundry, Waltham, Mass.; secretary, R. B. BONNER, Somerville Machine & Foundry Co., 14 Kent street, Somerville, Mass. Meeting the fourth Wednesday of each month at the Engineers' club, Boston.

The Buffalo Foundrymen

President, J. MCARTHUR, Washington Iron Works; secretary, W. J. WARK, E. J. Woodison Co., 140 Chandler street. Meetings each month at club rooms, 140 Chandler street.

Central Illinois Foundrymen's Club

President, H. M. HIRE, Hire Foundry Co., Peoria, Ill.; secretary, FRANKLIN WHITEHEAD, The Meadows Mfg. Co., Bloomington, Ill.

Chicago Foundrymen's Club

President, H. P. EVANS, Hubbard Steel Foundry Co., East Chicago, Ind.; secretary, ALBERT N. WALLIN, S. Obermayer Co., 2563 West Eighteenth street. Meetings first Thursday in each month at the City club, 315 Plymouth court.

Connecticut Foundrymen's Association

President, CARL S. NEUMANN, Union Mfg. Co., New Britain, Conn.; secretary, CHARLES S. PARKER, Charles Parker Co., Meriden, Conn. Meetings are on second Friday of each month in various parts of the state.

Detroit Foundrymen's Association

President RUSSELL M. SCOTT, Packard Motor Car Co., Detroit; secretary, WILLIAM J. MUHLITNER, Great Lakes Foundry Sand Co., 2100 Penobscot building, Detroit. Meetings third Thursday in each month except December, June, July and August at Masonic temple.

East Bay Foundrymen's Association

Secretary O. R. MOLLER, Electric Steel Foundry Co. Inc., 1328 Second street, Berkeley, Calif.

Electric Steel Founders' Research Group

Director, R. A. BULL, Assistant Director, C. N. RING; Central Office, 541 Diversey Parkway, Chicago.

Gray Iron Institute

President, WALTER L. SEELBACH, Forest City-Walworth Run Foundries Co., Cleveland; secretary, ARTHUR J. TUSCANY, Terminal Tower building, Cleveland.

Malleable Iron Research Institute

President, R. R. FAUNTLEROY, Moline Malleable Iron Co., St. Charles, Ill.; secretary, ROBERT E. BELT, Union Trust building, Cleveland.

Metropolitan Brass Founders' Association

President, WILLIAM EMBER, Jefferson Brass Foundry, 62 Delevan street, Brooklyn, N. Y.; secretary, WILLIAM E. PAULSON, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meeting second Wednesday in each month at the Building Trades club, 2 Park avenue, New York.

Newark Foundrymen's Association

President, J. L. CARTER, Sachs-Barlow Foundries, Inc., Newark; secretary, W. H. MANTZ, Atlas Foundry Co., Irvington, N. J. Meeting called by president.

New England Foundrymen's Association

President, ERNEST F. STOCKWELL, Barbour-Stockwell Co., Cambridge, Mass.; secretary FRED F. STOCKWELL, 205 Broadway, Cambridgeport, Mass. Meetings second Wednesday of each month at the Exchange club, Boston. Outings usually are held in the summer months.

Ohio Foundries Association Inc.

President, DON MCDANIEL, Hamilton Foundry & Machine Co., Hamilton, O.; secretary-manager, E. F. SCOTT, 418 Penton building, Cleveland.

Pacific Coast Founders Association

President, CHARLES J. P. HOEHN, Enterprise Foundry Co., 2902 Nineteenth street, San Francisco; manager, S. M. TRUITT, 55 New Montgomery street, San Francisco.

Philadelphia Foundrymen's Association

President, C. F. HOPKINS, Ajax Metal Co., Philadelphia; secretary, EARL SPARKS, 1623 Sansom street, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Pittsburgh Foundrymen's Association

President, W. E. TROUTMAN, Duquesne Steel Foundry Co., Pittsburgh; secretary-treasurer, WILLIAM J. BRANT, Wm. J. Brant, Bessemer building, Pittsburgh. Meeting on the third Monday of the month, except in July and August at Fort Pitt hotel.

Quad-City Foundrymen's Association

President, R. L. EICHMAN, Bettendorf Co., Bettendorf, Ia.; secretary-Treasurer, Stanley Brah. Meetings the third Monday of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

St. Louis District Foundrymen's Club

President, HORACE R. CULLING, Carondelet Foundry Co., St. Louis; secretary-treasurer, LEO J. FILSTEAD, John C. Kupferle Foundry Co., St. Louis.

Southern Metal Trades Association

President, JOHN S. SCHOFIELD, J. S. Schofield's Sons Co., Macon, Ga.; secretary, W. E. DUNN JR., Flatiron building, Atlanta, Ga.

Steel Castings Development Bureau

Research Director, GEORGE BATTY, 500 Stock Exchange building, Philadelphia.

Steel Founders' Society of America

President, J. E. MCCAULEY, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.; managing director, G. P. ROGERS, Graybar building, New York. Meetings: Cleveland, May 12-15, 1930.

Tri-City Technical Council

Chairman, C. F. SCHERER, Davenport Machine & Foundry Co., Davenport, Iowa; secretary, E. C. XANDER, assistant secretary, Tri-City Manufacturers association, Moline, Ill. Combined meetings held only one or two times a year on call.

Tri-State Foundrymen's Association

President, WILLIAM HOPPENJANZ, The Star Foundry Co., 221 Main avenue, Covington, Ky.; secretary, C. C. ERHART, Chris Erhart Foundry Co., Cincinnati. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

Twin City Foundrymen's Association

President, WILLIAM J. SNYKER, St. Paul Foundry Co., St. Paul; secretary-treasurer, C. E. LANGDON, 3849 Lyndale avenue, south, Minneapolis. Meeting third Wednesday of each month at Athletic club.

Washington Foundrymen's Club

President, J. W. ORPHAN, Lake Union Foundry Co., 1703 Westlake avenue, Seattle; secretary, EDWARD C. GUSTIN, The Prescott Co., 1 West Lander street, Seattle. Meetings second and fourth Tuesdays of each month at the Elks Temple, Fourth avenue and Spring street.

Western Foundrymen's Association

President, H. T. HORNSBY, Joplin, Mo.; secretary, E. L. GRAHAM, Acme Foundry & Machine Co., Coffeyville, Kans.

Wisconsin Gray Iron Foundry Group

Secretary, W. F. BORNFLETH, Cutler-Hammer Inc., Foundry Division, Milwaukee. Meetings on first Wednesday of each month at Hotel Schroeder, Milwaukee.

Trade Trends in Tabloid

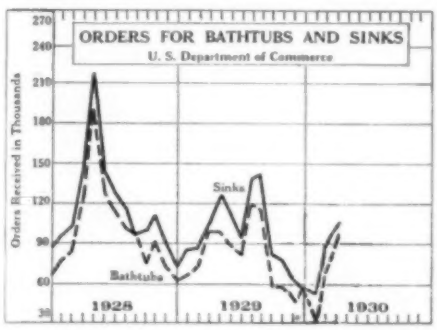
FOUNDRY operations are on the up grade, according to many visitors at the recent convention at Cleveland. While few companies will equal the records made in the banner year of 1929, operations as a whole tend to approach those in 1928, a normal year.

—T—T—

Approximately 42,000 more passenger cars were made in April than in March. The total of 396,043 cars practically equals the production in April, 1925 and 1926 and exceeds the production in the corresponding month in the remaining years since 1921.

—T—T—

Operations of steel foundries have



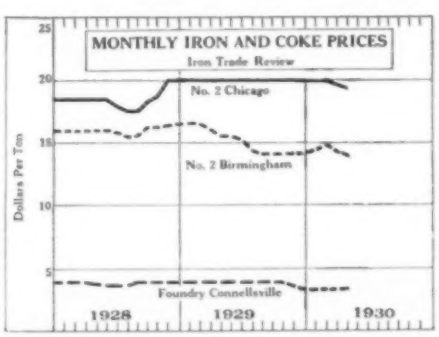
increased during the past two months. According to reports made at the St. Louis meeting of the Steel Founders Society of American the latter part of March, average operations were 78 per cent. Reports presented at the Cleveland meeting show average operations at 83.9 per cent.

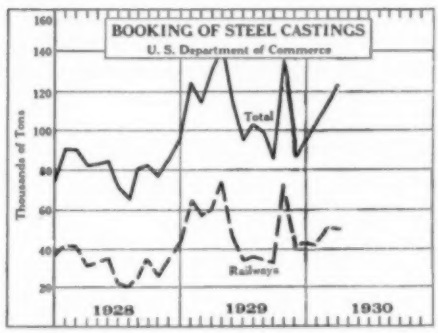
—T—T—

Car loadings for the week ended May 3 showed a sharp increase, reaching a new high point for 1930. However, the total for the week was exceeded by the corresponding week in 1929 by more than 100,000 cars. Loadings again decreased for the week ended May 10.

—T—T—

While advertised work in cast iron pipe remains dull, purchases recently





by contractors, industrialists and public utilities has brought the total of this type of business above that realized a year ago.

—T—T—

Malleable castings production in April dropped to 59,837 tons from 62,733 tons in March.

—T—T—

Sales of pig iron continue at about the same level as in April. Consumers appear to be awaiting further developments in the price situation.

—T—T—

Operations of foundries in the St. Louis district are spotty. While a few plants are working at full schedule, others are operating on a basis of two or three days a week.

—T—T—

Machinery manufacturers in the Pittsburgh territory are operating at a good rate and are well booked ahead

RAW MATERIAL PRICES
May 22, 1930

Iron	
No. 2 foundry, Valley	$18.50
No. 2 Southern, Birmingham	14.00
No. 2 foundry, Chicago	19.00
No. 2 foundry, Buffalo	18.50
Basic, valley	18.50
Basic, Buffalo	18.00
Malleable, Chicago	19.00
Malleable, Buffalo	19.00
Coke	
Connellsville beehive coke	$3.50 to 4.85
Wise county beehive coke	4.25 to 5.00
Detroit by-product coke	8.50
Scrap	
Heavy melting steel, Valley	$16.00
Heavy melting steel, Pitts	14.75 to 15.25
Heavy melting steel, Chicago	12.50 to 13.00
Stove plate, Buffalo	11.75 to 12.00
Stove plate, Chicago	9.50 to 10.00
No. 1 cast, New York	10.25
No. 1 cast, Chicago	13.00 to 13.50
No. 1 cast, Philadelphia	13.25 to 13.75
No. 1 cast, Pittsburgh	14.50 to 15.00
No. 1 cast, Birmingham	10.00 to 11.00
Car wheels, iron, Pittsburgh	14.50 to 15.00
Car wheels, iron, Chicago	13.75 to 14.25
Railroad malleable, Chicago	15.25 to 15.75
Agricultural mal., Chicago	13.50 to 14.00
Malleable, Buffalo	15.50 to 16.00
Nonferrous Metals	**Cents per pound**
Casting, copper, refinery	12.75
Electro, copper, producers	13.00
Straits, tin	31.70
Lead, New York	5.50
Antimony, New York	7.37½
Nickel, electro	35.00
Aluminum, No. 12, producers	23.00
Aluminum, No. 12, remelt	15.50
Zinc, East St. Louis, Ill.	4.62½ to 4.65

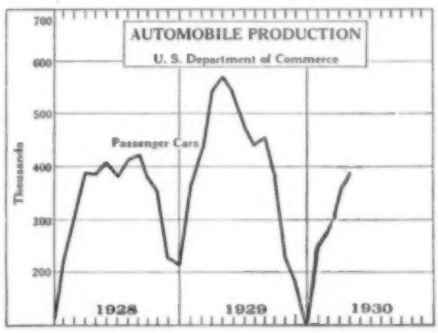
for the greater portion of the year. Roll and sanitary ware producers are experiencing a seasonal decline.

—T—T—

The buying flurry in the brass ingot market in Chicago, noted around the middle of May, has subsided to a certain extent. A spurt in western building activity is a factor which probably will affect brass foundry operations. Casting shops serving the oil and refinery fields are busy. Demand for railroad work has dropped.

—T—T—

Building awards for April were the highest in eight months but were below the seasonal average, according to the F. W. Dodge Corp. April



awards amounted to $483,251,700 compared with $456,119,000 in March.

—T—T—

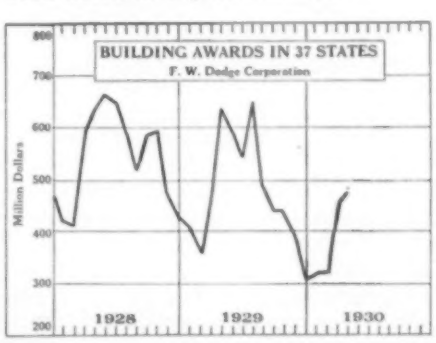
A slight increase is noted in freight car inquiries, the list now totaling approximately 3500 cars. Shipments of the Baldwin Locomotive Works in the first four months of the year totaled $10,566,429, practically three times the output for the corresponding period in 1929.

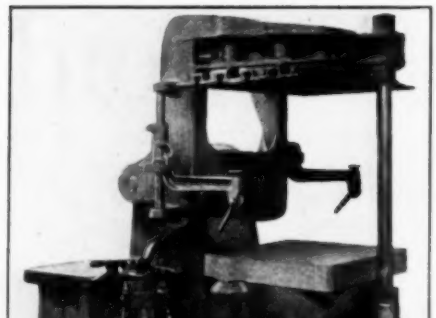
—T—T—

Orders for steel castings totaled 93,208 tons in April compared with 122,658 tons in March. Production in the latter month totaled 110,999 tons.

—T—T—

Inquiries for machine tools are scattered, indicating light months for July and August. A drop also has been noted in export business.





MACHINE COMBINES ALL OPERATIONS

Molding Machine Has Wide Range

Wm. H. Nicholls Co., Richmond Hill, N. Y., has announced a molding machine combining jolt, roll-over, squeeze, and pattern draw operation. General features are shown in the accompanying illustration. Elimination of intricate parts has been one of the purposes of the new design. The base, jolt cylinder, squeeze and draw cylinder as well as all pads and brackets are cast in one piece which eliminates the possibility of parts jolting loose. The outside of the squeeze head or pattern frame is supported between a 2½-inch hardened flanged nut at top and bottom which prevents sag or twist of the pattern from over-hang when the pattern draw is started.

The squeeze head or pattern frame support quickly can be set parallel with the top of the draw or squeeze head. The squeeze is made on the upstroke of the piston and the mold is drawn away from the pattern by gravity on the down or return stroke. The machine has a 21-inch diameter. All operations are controlled with one valve handle.

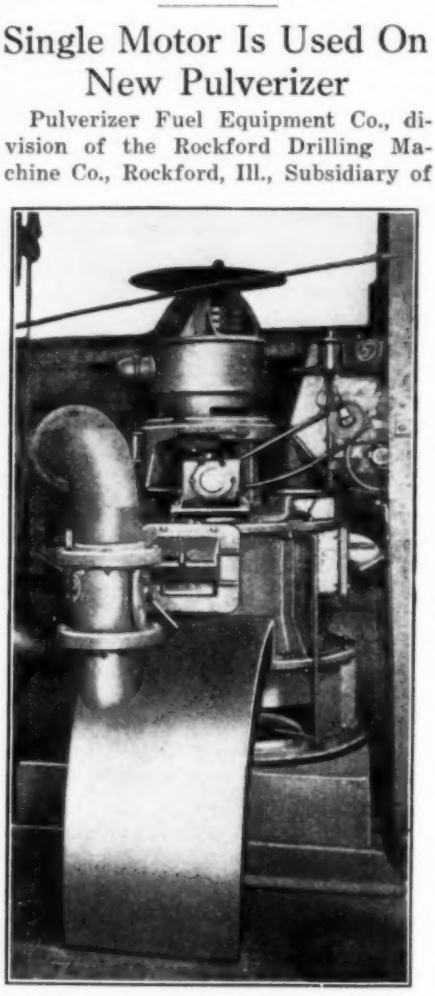
New Screen Is Added to Sand Machine

American Foundry Equipment Co., Mishawaka, Ind., has added an interesting screen to its standard heavy duty cutting and piling machine which provides for cutting, screening and piling on a portable production basis. The cutting and piling machine is shown in the accompanying illustration.

The screen is made of ¾-inch expanded metal designed to secure maximum screen area. A 2-horsepower motor mounted on the screening device drives an eccentric through a double roller chain which propels the screen in a rotary motion. This motion is more pronounced at the bottom of the screen where the greatest amount of work is done. Small plows or deflector plates are placed at the bottom of the screen so that sand may be piled in windrows to eliminate shoveling. Chutes are placed at either side of the screen for the removal of refuse.

Single Motor Is Used On New Pulverizer

Pulverizer Fuel Equipment Co., division of the Rockford Drilling Machine Co., Rockford, Ill., Subsidiary of



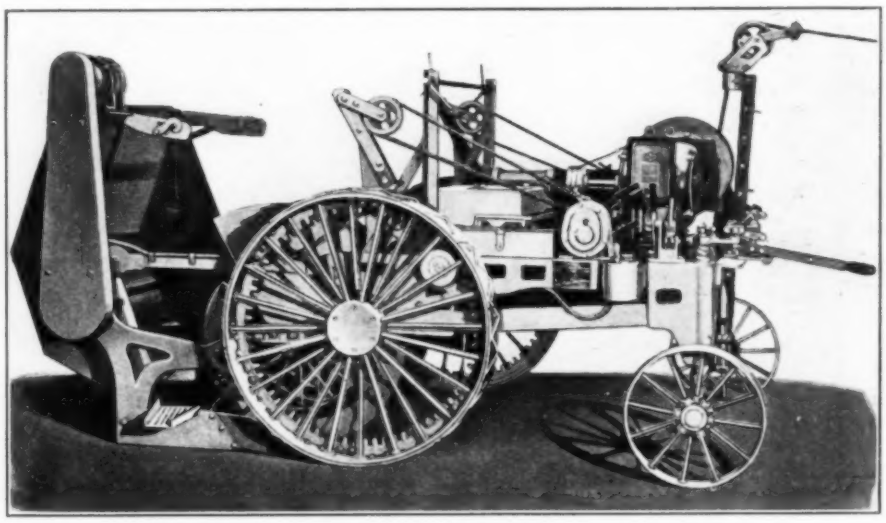
NEW PULVERIZER HAS A DISK AND PLOW TYPE FEEDER

the Borg-Warner Corp., Chicago, has introduced a new type pulverizer with many new features. The pulverizer shown in the accompanying illustration is built with a disk and plow type feeder which extracts tramp iron by a drum type magnetic separator. The feeder consists of a revolving table which receives the coal and a plow which scrapes the desired amount of fuel off the table. The coal drops from the table and is fed into the top of the pulverizer. The unit is a vertical shaft type mill with one stage of swing hammers. The fuel is held in liners designed in the form of circular pockets. Coarser particles are held in the pockets by centrifugal force of the beaters thus creating a combined impact and attribution action on the coal. A slight air current separates the fine dust and carries it to the discharge where it is blown through the burners of the furnace.

The unit requires only one motor for feeding, pulverizing and furnishing combustion air. It also is equipped with an exhauster of sufficient capacity to supply all air for combustion. Other features of the pulverizer include a graduated dial on the plow to control the feed; no belts or ratchets and no pulverized coal storage. The air inlet at the top of the mill may be closed to increase the fineness of pulverization. Repairs may be through doors in the housing without dismantling the unit.

Gives Molybdenum Uses

The Climax Molybdenum Co., New York, recently has published an 84-page bulletin entitled, "Molybdenum in 1929," showing various applications of molybdenum and giving data on the applications. Practically all the material presented has been taken from various technical publications. The bulletin is divided into nine sections showing the application of molybdenum in nitriding, acid-resistant



PORTABLE PRODUCTION SAND MACHINE HAS NEW SCREEN

alloys and steel, gray iron castings, alloy steel castings, aircraft, automobile, special alloy steels, miscellaneous uses, and British, French and German views of molybdenum in alloy steels.

Grinder Is Equipped with Ball Bearings

Van Dorn Electrical Tool Co., Cleveland, has introduced a 7-inch, portable bench grinder for sharpening tools and for light grinding. The grinder is equipped with ball bearings mounted in dustproof housings. It has a dynamic balance which reduces vibration to a minimum. It is supplied with grinding wheels, adjustable tool rests, wheel guards, switches and cable and is available for numerous voltages and currents.

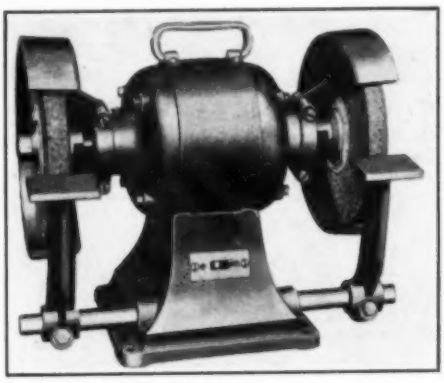
Introduces a New Type Foundry Screen

The Deister Concentrator Co., 901 Glasgow avenue, Fort Wayne, Ind., has introduced a new type foundry screen with a grizzley attachment. The grizzley bars are pivoted on a shaft at the upper end and spaced to a cross beam at the lower end which is connected to the vibrating beam of the screen jacket. The vibration in the screen jacket is imparted to the grizzley bars.

Sand is shoveled to the screen surface and during the screening operation cuts, tempers, fluffs, aerates and heaps the sand. Refuse travels down the inclined surface and is collected in a removable waste box at the lower end.

Power is supplied by a 1/6 horsepower, ball bearing motor which can be attached to any light socket or outlet with 110 or 220 volt, single phase, alternating current. It is direct connected to a roller bearing vibrator with a totally enclosed drive shaft. Advantages of that type screen include a free swinging screen cloth with 12 square feet of surface which can be changed in approximately 5 minutes. Only the screen cloth vibrates and standard equipment is supplied with a ½-inch opening. A tilting mechanism permits the slope of the screen to be changed from 20 to 30 degrees to meet different conditions.

The unit is of all steel construction and clears a heap 30 inches high, screens a heap 36 inches high and straddles a heap 48 inches wide. It has a three point support chassis which makes it adaptable to uneven floors.

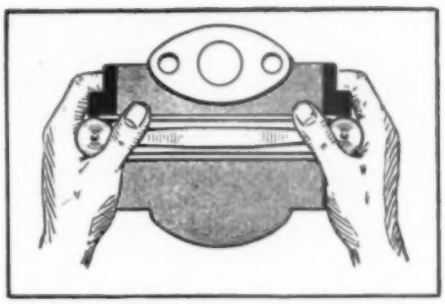


THE GRINDER IS SUPPLIED FULLY EQUIPPED

One man can operate the device. The unit is supplied with 50 feet of heavy cable which allows effective use over a large area.

New Template Measures Surface Profile

The new template shown in the accompanying illustration has been placed on the market by the American Maco Template Co. Inc., 44 Whitehall street, New York. The instrument is designed for taking accurate profiles of machine parts, and in the foundry industry it may be used in patternmaking. The construction of the new tool is simple. A number of hard drawn brass strips, 0.007-inch thick, are set in an aluminum frame. These laminations are held in position by two clamps, fitted with sections of corrugated rubber, providing security of the laminae from falling out.



TEMPLATE IS USED FOR MEASUREMENT OF PROFILES

When an exact template of any profile is required, the screws are loosened and the adjustable template pressed against the contour. The result of this pressure is that the laminae take an outline of the surface against which they are pressed. When the operation is completed, the screws are locked holding the brass laminations in place. From the template thus produced, other and permanent templates may be produced or a record can be made for reference.

Pittsburgh Foundrymen Elect Officers

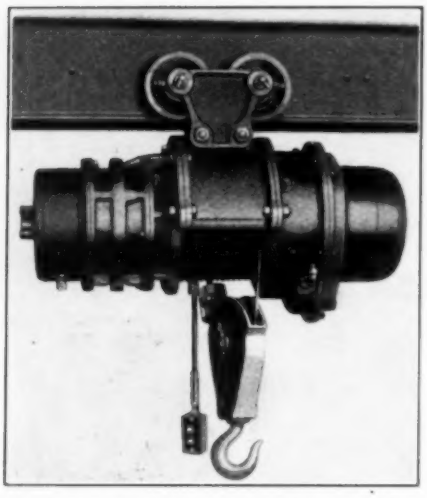
W. N. Truxell, foundry engineer of the Potter Coal & Coke Co., Greensburg, Pa., was the principle speaker at the monthly meeting of the Pittsburgh Foundrymen's association held May 19. Mr. Truxell spoke on "Present Day Cupola Practice in American Foundries." He discussed various phases and problems of iron and steel melting as well as the alloying of special irons.

The election of officers for the ensuing year was held at the meeting. Following officers were elected: President, W. E. Troutman, Duquesne Steel Foundry Co., Pittsburgh; vice president, H. F. Seifert, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.; secretary-treasurer, William J. Brant, Pittsburgh.

Joins Sales Force

Carl E. Johnson, for the past 10 years associated with the Garden City Sand Co., Chicago, has become connected with the Harbison-Walker Refractories Co., Pittsburgh, in a sales capacity. He will have charge of the Indiana territory with headquarters at 234 Bankers Trust building, Indianapolis.

This New Type Foundry Screen Incorporates a Free Swinging Screen Cloth which Can Be Changed Quickly



HOISTS ARE EQUIPPED WITH ROLLER TYPE BEARINGS

New Electric Hoist Is Constructed Simply

Milwaukee Electric Crane & Hoist Corp., Milwaukee, a division of the Harnischfeger Corp., Milwaukee, recently placed on the market a new line of electric hoists of from ½ to 10 tons capacity. The units, one of which is shown in the accompanying illustration, are simply constructed to keep their maintenance cost low and are built for a rapid rate of travel to make them adaptable for many services. The new line of hoists is equipped with roller bearings throughout, forged, heat-treated gears and pinions, forged steel wheels and alloy steel shafts ground to size. Units are equipped with button, single or variable control and oil bath lubrication for gears and brakes.

Requires Many Castings

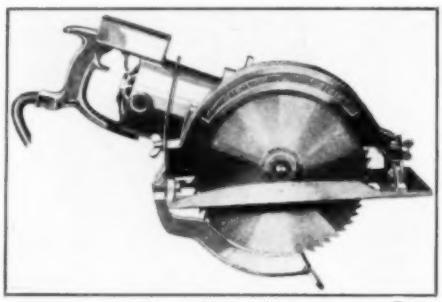
Five hundred and twenty-six tons of bronze castings and forgings will be required for 30 riser valves placed with the American Locomotive Co., New York, by the board of water supply of that city. In addition the valve specifications call for 159 tons of steel castings, 70 tons of fabricated steel, 180,000 pounds of forged bronze rods, 115,000 pounds of brass pipe and 16,000 pounds of miscellaneous bronze. Nine of the valves will be 48-inch and 21 will be 72-inch. Installation will be mostly in shafts bored in the Bronx, Brooklyn and Queens for the new enlarged water system being tunneled to New York.

L. H. Emrick, 424 Book building, Detroit, has been appointed district sales representative in the Toledo and state of Michigan territories for the Despatch Oven Co., Minneapolis, manufacturers of industrial ovens.

Electric Hand Saw Has Safety Guard

DeWalt Products Co., Lancaster, Pa. recently has acquired the electric hand saw and electric combination mortiser and router formerly made by the Wodack Electric Tool Corp., Chicago. The business of the F. L. Rogers Co. of New York and Chicago has also been purchased by the Dewalt Co.

The electric hand saw which has been acquired is shown in the accompanying illustration. The blade of the saw is mounted in rubber bushings designed to reduce cutting shock to a minimum. Driving power is supplied by a motor made by the General Electric Co., Schenectady, N. Y. A trigger switch conveniently located to the hand grip is the motor control. A blower for removing saw-dust is designed to keep the cutting line al-



HAND SAW IS POWER DRIVEN

ways visible. The blades revolve in a clockwise direction which, it is claimed, causes the machine to hug the work. A gravity safety guard is provided and also a bevel cutting feature. The saw is built in four models ranging from a light model, weighing only 15 pounds, with a cutting capacity of 2⅝-inches, to the large power saw carrying a 1-horsepower motor for handling 4½-inch material.

Whiting Corp. Forms Canadian Company

Whiting Corp., Harvey, Ill., has formed the Whiting Corp. (Canada) Ltd., with headquarters at 129 Adelaide street west, Toronto, Ont., for the complete manufacture of all products in Canada formerly made by the company in the United States and exported into Canada. Manufacturing operations will be carried on at Hamilton, Ont. Officers of the new company include Col. James Mess, president; A. H. McDougal, vice president; George T. Scroggie, secretary and director and M. J. Evans and Col. R. J. Massie, directors. Branch offices will be maintained in Montreal, Que.; Winnipeg, Man.; Edmonton, Alta.; Calgary, Alta,; and Vancouver, B. C. The Canadian organization also will represent the Whiting Corp. subsidiaries, Swenson Evaporator Co., Grindle Fuel Equipment Co., Harrington division.

To Hold Short Course in Gas Engineering

The University of Illinois, Urbana, Ill., in co-operation with the Illinois Gas association will hold its fifth annual short course in gas engineering from June 16 to 28. The course of study covers 8 hours per day and is under the direction of professors and leading authorities in that subject. The course covers subjects relating to utilization of gas for industrial, hotel and restaurant, house heating and refrigeration purposes. General principles of combustion and gas burning equipment also will be discussed. Dr. D. B. Keyes, professor of industrial chemistry, will be in charge of the course. Applications for enrollment may be secured by addressing George Schwaner, secretary, Illinois Gas association, 405 Mine Workers building, Springfield, Ill.

New Vacuum Cleaner Has Many Applications

The Breuer Electric Mfg. Co., 852 Blackhawk street, Chicago, recently has placed on the market a new type portable tank, industrial, vacuum cleaner. It is designed especially for heavy duty work in cleaning machinery, motors, overhead pipes, girders, walls, floors, office rugs etc. The new model uses an oversize 2/5 horsepower motor made by the General Electric Co., Schenectady, N. Y., which is mounted on ball bearings made by the Norma-Hoffmann Bearings Corp., Stamford, Conn. The mo-

THE MOTOR IS DETACHABLE AND CAN BE USED AS A PORTABLE BLOWER

tor is mounted on a cast aluminum cover which fits over a steel tank finished in aluminum. A complete set of attachments is furnished to take care of any cleaning requirements. A special feature is the possibility of the removal of the motor from the cover to be used as a portable blower.

Add Lift Truck Division

Yale & Towne Mfg. Co., Stamford, Conn., has added a lift truck and skid platform manufacturing division to the Philadelphia branch. The new unit is housed in a four-story, concrete building equipped for production. T. T. Ludlum, formerly of the Holyoke, Mass., branch, is in charge of production and R. L. Higgins will handle the sales.

Standardize Drives for Screw Conveyors

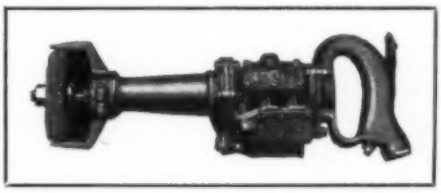
H. W. Caldwell & Son Co., Chicago, has standardized its drives for screw conveyors which now are made in two arrangements. The new type drives for screw conveyors from 8 to 16 inches in diameter are compact, efficient, positive and quiet in operation.

The first type consists of two-speed reductions from the motor to the conveyor by a chain drive enclosed in an oil-retaining, steel casing and a worm gear speed reducer. The other type consists of a direct coupled reducer mounted with the motor on the unit base plate. That type permits the selection of a worm gear reducer according to horsepower rating without regard to the size of the conveyor trough on which the drive is to be mounted.

All reducer bearings on both types are of the antifriction variety with automatic lubrication. Oversize bearings on the worm gear shaft take the conveyor end thrust in either direction. These drives are adaptable to horizontal or inclined conveyors with proper adjustment of the oil level. Motors of 860, 1160, 710 and 1430 revolutions per minute may be accommodated on the drives which provide a range of conveyor speeds from 45 to 125 revolutions per minute.

Grinder Is Light Weight

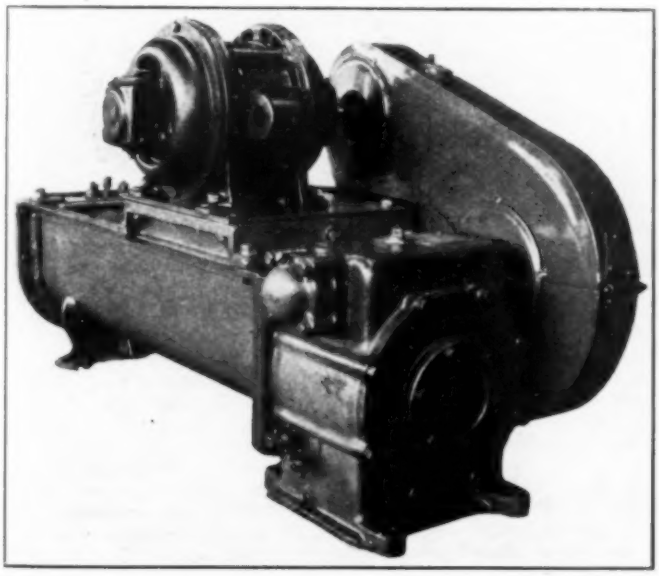
Chicago Pneumatic Tool Co., 6 East Forty-fourth street, New York, recently introduced a new type of a pneumatic portable grinder, which is especially adaptable for light grinding. The machine is equipped with a closed type pistol grip throttle handle as standard equipment, but may be purchased



PISTOL GRIP THROTTLE HANDLE IS STANDARD EQUIPMENT

with the straight type throttle handle if desired. It is built for ¾ x 4-inch wheels with a maximum speed of 4400 revolutions per minute. It has an overall length of 16½ inches and weighs 8¼ pounds net. A grinder of this type with standard equipment is shown in the accompanying illustration.

Earl D. Stearns, formerly vice president, Fairfield Engineering Co., Marion, O., and former president of the Stearns Conveyor Co., Cleveland, has been appointed western sales manager of the Robins Conveying Belt Co., New York.



New Drives Are Adaptable to Horizontal or Inclined Conveyors

Importance of Nickel Is Told in Broadcast

The story of the development and of the importance of nickel was told in a radio program broadcast May 27, over a coast to coast network of 33 stations of the National Broadcasting Corp. The production was sponsored by Westinghouse Electrical Mfg. Co., East Pittsburgh, Pa., and brought to the radio audience an appreciation of the part that nickel plays in providing those alloys so necessary to modern industry and progress.

Nickel first was considered a worthless metal and was treated as refuse when found in the mining for other metals. How its properties as an alloy were discovered and how important it has become was told. A. J. Wadhams, manager of nickel development and research, was the guest speaker.

Book Review

Standard Costs, Installation, Operation, and Use, by G. Charter Harrison; cloth, 308 pages, 5½ x 8½ inches; published by the Ronald Press Co.; furnished by THE FOUNDRY for $5 plus postage. In England the book may be obtained from the Penton Publishing Co. Ltd., Caxton House, Westminster, London, for 25s 6d.

The book has been written to provide a complete manual of accepted practice in regard to standard costs. The theory and fundamentals of the standard cost method are discussed and contrasted to the job-order method. The author claims, for the system described, distinct advantage over older methods in that clerical labor is reduced and executive efficiency increased since emphasis in the records is placed only on variations from a routine procedure. The methods of setting standards and providing for their revision, installation of standard cost systems, checks of actual against standard, and the results of operation are given in full detail.

Executives and accountants will find the book useful. The essentials and details of the standard cost method are described in concise and readable fashion. Numerous tables, illustrations, and charts provide the detail necessary to design a system of this type. The author is a partner, Stevenson, Harrison & Jordan, fellow, Institute of Management, former national director, National Association of Cost Accountants.

E. H. Bollenbacher, 725 Forsyth building, Atlanta, Ga., has been appointed representative in that district for the Pennsylvania Pump & Compressor Co., Easton, Pa.

What the Foundries Are Doing

Reflecting the Activities of the Gray Iron, Malleable, Steel and Brass Shops

Davis Foundry Co., Newcastle, Ind., recently installed a new blower system.

Galt Malleable Iron Co., Galt, Ont., recently was damaged by fire. Loss was approximately $25,000.

Texas Brass Mfg. Co., Houston, Tex., has been incorporated with $25,000 capital by D. D. Daugherty, 1929 West McKinney street.

Chemung Foundry Corp., Elizabeth, N. J., has been incorporated by White, Elmore & McLean, to operate an iron foundry.

National Pattern Works, Inc., Dayton, O., has been incorporated by Otto R. Harping and Clarence J. Stocklein.

L. S. Sales Machine Co., Walpole, Mass., has been incorporated by Walter C. Rockwood and Stephen P. Cushman, to engage in general manufacturing and foundry business.

The foundry of the Mullins-Gilson Mfg. Co., Rushville, Ind., formerly a subsidiary of the Arbuckle & Co., was damaged by fire recently. Loss was estimated at $45,000.

Brooklyn Brass Works, 263 Scholes street, Brooklyn, N. Y., will build a 2-story, 24 x 100-foot foundry addition. Plans are through Lee & Hewitt, 53 Park place, New York.

Reading Steel Casting Co. has moved its Houston, Tex., branch, to new quarters, 100 x 150 feet, at Live Oak and Walker streets. J. H. Bynum is district manager.

Champion Products Co., Worcester, Mass., has been incorporated by Arthur W. Goddard and Napoleon R. Thibert, to conduct a general machine and foundry business.

Chapman Valve Mfg. Co., Indian Orchard, Me., is having plans prepared by McClintock & Craig, architects, Bridge street, for a one-story addition to cost approximately $50,000 at Springfield, Mass.

D. A. Ebinger Sanitary Mfg. Co., 403 West Town street, Columbus, O., has a permit for a 1-story foundry building addition at 402 West Rich street. E. Elford & Son, 555 South Front street, has the contract.

Contract has been awarded by the Titusville Iron Works Inc., Titusville, Pa., for a 50 x 150-foot foundry building to cost about $200,000. J. T. Dillon Sr. is president. Plant will be two stories.

The plant of the Federal Brass & Mfg. Co., North Main street, Marysville, O., recently was damaged by fire. The loss, which was placed at $250,000, did most damage to machinery and equipment. Scott Van Etten is plant manager.

Walworth Mfg. Co., 88 Pearl street, Boston, manufacturer of valves, fittings and tools, suffered recent damage by fire to its pipe shed unit on Summer street and Causeway. The loss is estimated at $50,000.

Crucible Steel Castings Co., Milwaukee, has broken ground for a brick and steel foundry addition, 100 x 135 feet, at 1330 Fifteenth avenue, to cost about $50,000 complete. Albert C. Lange is president and general manager.

W. J. Loth Stove Co., Inc., Waynesboro, Va., manufacturer of stoves, recently was acquired by the Virginia Public Service Co., Charlottesville, Va., and expansion is said to be probable.

Zoll Foundry Co., Elizabeth, N. J., has been acquired by the Chemung Foundry Corp., Elmira, N. Y. Expansion plans are reported, which will include new equipment and an addition for the local unit.

American Cast Iron Pipe Co., Birmingham, Ala., is building an addition to its monocast department. The new structure will cost $50,000 and is expected to be completed during the summer.

United Boiler Heating & Foundry Co., 455 Hohman street, Hammond, Ind., recently has completed a new 7-room office building, 45 x 60 feet. Charles N. Nau is president and general manager.

Scovill Mfg. Co., Waterbury, Conn., maker of brass, aluminum and steel castings, has plans through H. L. Thompson, architect, North Main street, for the construction of a 3-story plant on Ambrose street which will cost approximately $200,000.

Adamson Mfg. Co., East Palestine, O., operator of a foundry and manufacturer of storage tanks, suffered plant damage by fire recently. Loss was estimated at approximately $75,000. Loss was confined to one department and temporary repairs have been made.

The consolidation of the Oakland Foundry Co., and the Quality Stove & Range Co., both of Belleville, Ill., recently was completed through the purchase of stock in the Quality company by Hugo Ehret, secretary and general manager of the Oakland company.

Reliance Steel Castings Co., Twenty-eighth and Smallman streets, Pittsburgh, is reported to have rejected plans for a plant addition. New plans are being made by Lake & Davidson, Negley building. They will include a foundry addition.

National Bronze Co. Ltd., St. Laurent, Que., a subsidiary of the Robert Mitchell Co. Ltd., Montreal, has opened its new foundry. A banquet attended by industrial and scientific leaders marked the opening. The control laboratory, under direction of Harold J. Roast, is a feature of the plant.

Kuhn Bros. Co., 1800 McCall avenue, Dayton, O., manufacturer of cast iron fittings, advises that Charles Shock is contractor for a 160 x 190-foot warehouse addition now in the process of construction. The new unit will cost approximately $45,000. Plant alterations to cost approximately $2500 also will be made.

Patterson Foundry & Machine Co., East Liverpool, O., has inaugurated a $100,000 improvement program including the erection of an addition and the installation of an electric furnace and annealing plant. The erection of the new building will begin within the next sixty days. It will house a steel foundry.

Richard B. Carran & Sons, Ludlow, Ky., brass foundry operators, have awarded the general contract to Ferro Concrete Construction Co., Third and Elm streets, Cincinnati, for a one-story, 50 x 56-foot plant addition. The cost of the new construction is estimated at $30,000.

D. R. Smith, 157 Ohio street, Wichita, Kans., is reported having prospects for the establishment of a foundry to employ 200 men and to cost approximately $200,000. Applications for charter will be made for the company. Prospects are that the company will be in operation within 90 days.

Pierce, Butler & Pierce Mfg. Co., 41 East Forty-second street, New York, suffered severe damage by fire to its plant, Pearl and Canal streets, Syracuse, N. Y., recently. Loss was estimated at approximately $1,000,000. Company manufactures steam and water heated boilers.

Zimmerman Bros. & Co., 4020 South Michigan avenue, Chicago, manufacturers of bank equipment, advises they will build a 50 x 65-foot, 1-story foundry for the manufacture of bronze castings. Contract has been let to T. F. Barrett Construction Co. Equipment will consist of overhead track for handling crucibles and three oil-fired furnaces for melting bronze.

Ohio Pattern Works & Foundry Co., 2730 Spring Grove avenue, Cincinnati, which recently acquired the Eureka Brass Works, Inc., will manufacture a complete line of valves, patterns brass and aluminum castings. The Ohio Pattern Works' capital stock was increased to $1,000,000 last year to provide for expansion in the recently completed merger.

Deere & Co., farm implement manufacturers, have begun construction work on six buildings at their Moline, Ill., and Waterloo, Iowa, works. Two of the new units, to cost about $116,000, will be added at Moline in connection with the foundry division. The remaining four buildings, to cost more than $300,000, are being built at the Waterloo plant and will be given over to the production of tractor wheels.

New Trade Publications

STRIP HEATERS—General Electric Co., Schenectady, N. Y., has published data describing its electric resistance strip heaters. Possible applications are suggested.

TUMBLERS—Whiting Corp., Chicago, describes typical designs of its tumbling equipment and dust filters in a 40 page booklet recently issued. Illustrations and data on designs and operating characteristics are included.

TROLLEYS—Robbins & Myers, Inc., Springfield, O., has issued a folder on its steel frame, roller bearing trolley. The piece of equipment is described and illustrated in detail. Line drawings show the construction and features, tables of dimensons are given and the specifications are included.

BELT CONVEYORS—Stearns Conveyor Co., Cleveland, a division of the Chain Belt Co., Milwaukee, has made available a catalog of its different types of conveyors and gives information on the various parts of these machines. The booklet also shows views of typical installations.

GRINDERS—Grinders, polishers and motor air cleaners manufactured by the Hammond Machinery Builders, Kalamazoo, Mich., formerly Hill-Curtis Co., are described in a bulletin now being distributed. The publication includes information on tools, grinders, production grinders, casting snaggers and multi-speed casting-grinders.

BLOWERS—Wilbraham-Green Blower Co., Pottstown, Pa., has published a 16-page folder on its cupola blowers. The folder describes and illustrates the blowers, shows details of construction by line drawings, depicts by half-tone reproductions several typical installations and gives tables of specifications for the different types of machines.

MOLDING MACHINES—Moline Iron Works, Moline, Ill., has issued a pamphlet on its line of molding machines. The folder tells the advantages of the machines and lists many of the foundries both in the United States and abroad that have installed those machines. Various types are shown and the dimensions and the class of molding in which they are most efficient is given.